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NOW CONSULTING SURGEON TO GUY'S.

Edited by

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Editor and Translator of Celsus de Medicina, &c.

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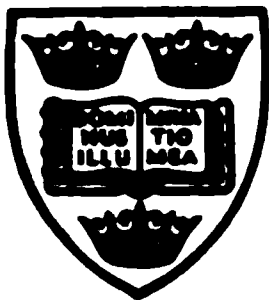
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N.B. The reader will please to observe that the descriptions given at pages 9, 47, 62, 83, 90, 91, 125, 127, are superfluous, having been superseded by another arrangement.

THE PRINCIPLES AND PRACTICE OF SURGERY.

OF HERNIA.

LECTURE XXXIX.

GENERAL DESCRIPTION OF HERNIA.

A **PROTRUSION** of any viscus from its proper cavity is denominated **Definition.**
a **hernia**. The protruded parts are generally contained in a bag,
formed by the membrane with which the cavity is naturally lined.

Several parts of the body afford examples of this disease. A **Encephalic**
deficiency in the bones of the head will sometimes allow the pro- **hernia.**
trusion of part of the brain and its membranes, from the inner to
the outer side of the scull, forming a hernia of this organ.

An imperfect state of the intercostal muscles may permit part of **Thoracic.**
the lung, with its pleura, to form an external tumour, or hernia of
the contents of the chest.

But the disease most frequently occurs about the cavity of the **Abdominal.**
abdomen; and on this account, as well as from its superior im-
portance in a surgical point of view, I shall confine my observations
to this species, with its several varieties.

Many reasons may be assigned for the very frequent occurrence **Causes of its**
of protrusions from the abdomen. **frequent oc-**
currence.

First: The viscera of this cavity are numerous, some of them
very moveable, and others loosely connected by peritoneal attach-
ments with the surrounding parts; and they are constantly ex-
posed to changes of size and relative situation, from sudden or
gradual distention.

Secondly: The parietes of the abdomen are composed of muscles
which, when in action, contract the dimensions of this cavity, com-

press the bowels, and thus have a tendency to force them from their natural situation.

Thirdly: For the passage of vessels and nerves, these muscles and their tendons have various apertures which, though naturally only large enough for that purpose, often become so much relaxed as to allow the viscera themselves to protrude.

Lastly: The muscles are sometimes imperfectly formed, and the viscera escape through unnatural apertures.

The following are the situations in which abdominal herniæ are found.

Situations of the abdominal.

First: It appears at the abdominal rings, generally passing in the same course with the spermatic cords in the male, and the round ligaments of the uterus in the female; thence it is continued down into the scrotum in the one sex, and the labium pudendi in the other. This hernia of the abdominal ring is known to surgeons under the various appellations of inguinal hernia, bubonocoele, scrotal hernia, and oscheocoele.

Inguinal.

Crural.

Secondly: A hernia also penetrates under Poupart's ligament, forming a tumour at the inner and upper part of the thigh. In this situation it is called femoral hernia, crural hernia, or merocele.

Umbilical.

Thirdly: Another species is formed at the navel by a protrusion through the opening which was formed in the foetus for the passage of the umbilical cord. This has received the name of umbilical hernia, or exomphalos.

Ventral.

Thyroideal.

Fourthly: Similar protrusions take place through the tendinous covering of the anterior part of the abdomen. The linea alba and semilunaris are perforated to transmit vessels passing to the common integuments: when these holes are either originally of an unusual size, or are enlarged during a relaxed state of body, herniæ will occasionally be formed in them, which are then called ventral.

Fifthly: Another part, at which hernia sometimes appears, is the foramen ovale of the pelvis; it then takes the name of the aperture, and is termed hernia foraminis ovalis, obturatoria, or hernia thyroidea.

Ischiatic.

Sixthly: Sometimes, though rarely, a hernia is produced at the

ischiatric notch projecting by the side of the sciatic nerve under the glutæi muscles. This takes the name of the part, and is termed **hernia** of the ischiatic notch, or ischiatocele.

Seventhly: Sometimes a hernia passes between the bladder and rectum in the male, and between the rectum and uterus in the female, appearing in the perineum. It is then called **hernia perinei**. Perineal.

Eighthly: I have seen the vagina protruded by a descent of the viscera between the rectum and uterus, and pushed backwards by the bladder, forming a considerable external tumour when the bladder was full, which disappeared as soon as it was emptied. Vaginal.

Ninthly: I have met with a hernia protruding into the labium pudendi, passing under the ramus of the ischium with the internal pudendal artery, but continued into the pelvis by the side of the vagina. Pudendal.

Tenthly: Hernia has been known to protrude through the diaphragm, sometimes by the side of the œsophagus, sometimes accompanying the vena cava inferior, sometimes, though more rarely, by the side of the aorta, but more frequently through unnatural apertures in the muscle. Diaphragmatic.

Eleventhly: I have two preparations in my possession, of **hernia** occasioned by the viscera passing between the laminæ of the peritoneum; in one of these they passed into the mesentery; Mesenteric.

Twelfthly: In the other into a bag formed by a separation of the laminæ of the mesocolon, in which all the small intestines were contained. When the mesentery is imperfectly formed, openings are sometimes found in it, through which the viscera pass and become strangulated; these can scarcely be termed **herniæ**, as the intestine still remains within its proper abdominal cavity. Mesocolic.

That species of hernia, which, from its frequently appearing at the time of birth, is called **congenita**, takes the same course through the abdominal rings as the inguinal hernia; but instead of passing down upon the fore part of the spermatic process, it descends within the tunica vaginalis testis, and ought therefore to be named the **hernia tunicæ vaginalis**. Congenital.

There is no part of the abdomen, excepting where the parietes

The most frequent.

are formed of bone, at which hernia may not occur; for, when the formation of the muscles is defective, it may happen even at the loins, in which case the kidney has been known to be part of the protruding substance. But of all the varieties of this disease which I have enumerated, the inguinal, femoral, and umbilical herniæ most frequently occur.

Sex.

The difference in the structure and œconomy of some parts of the abdominal parietes in the two sexes, renders the one sex disposed to that kind of hernia, from which the other is comparatively exempt; thus the large size of the inguinal canal in men, causes inguinal hernia to be a very common disease among them; whilst among females, it is but rarely met with; and on the contrary, the proportions of the female pelvis and distention of the abdomen from pregnancy, together with other circumstances, dispose this sex to be the frequent subjects of crural and umbilical herniæ, which may be regarded as uncommon diseases in man.

Named from contents.

The names that have been given to different kinds of hernia, have been derived from their contents, as well as their situations. If they contain only omentum, they are called omental hernia, or epiplocele; if only intestine, intestinal hernia, or enterocoele; if both omentum and intestine, entero-epiplocele; if the stomach is contained in the tumour, gasterocoele; if the liver, hepatocele; if the bladder, cystocoele, or hernia cystica; if the uterus, hysterocoele; and the same of others; for, excepting the duodenum and the pancreas, which are too closely connected with the spine easily to change their situation, all the different abdominal viscera have occasionally been found to form the contents of a hernial tumour.

Viscera most frequently found in them.

However, the viscera usually met with in hernia are the omentum, and the ileum; the next in frequency is the colon, then the cæcum, and lastly the jejunum; sometimes the appendix cæci is the only part of the intestine found in the hernial sac.

Hernial sac.

The cavity of the abdomen is every where lined by peritoneum, which in hernia generally protrudes prior to the descent of any viscus, and thus a bag or sac is formed by this membrane, in which the protruded viscera are afterwards contained. To this there are

occasional exceptions, arising from some of the viscera being only partially covered by peritoneum in their natural state.

The older surgeons thought that herniæ were formed by a laceration of the peritoneum and abdominal muscles, which gave rise to the term *rupture*; but dissection has proved that such a rupture of the membrane scarcely ever happens. The peritoneum in forming a hernial sac is not dragged from its natural situation, but becomes elongated by gradual distention, and it is usually not only lengthened, but slightly thickened; for a long continued pressure of moderate force will produce an elongation and thickening of fibre, though a greater degree will bring about an entire absorption of parts. This is proved, in the first case, by the vast increase of size and thickness which the tunica vaginalis undergoes in an old hydrocele; and in the second, by the entire removal of the sternum and cartilages of the ribs in aneurism. It is by the first of these principles in the animal œconomy that a hernial sac is produced, and if the sac be compared with the peritoneum from which it originated, it will generally be found to be a more dense and compact membrane. But when the hernia becomes of very considerable magnitude, the peritoneum forming the sac becomes thinner than natural; for the extension may go beyond the degree at which pressure thickens; and from this cause it is that in old and large herniæ, the peristaltic motion of the intestines may sometimes be seen through the sides of the sac. This is also one reason why herniæ are sometimes found without sacs, for, the process of extension having ceased, the sac becomes either entirely absorbed or remains only at the orifice; and hence, over the larger part of the tumour in one species of hernia, frequently no covering is left for the protruded viscera but skin and cellular membrane.

Its formation.

Sometimes thinner than the peritoneum.

On the other hand, the sac has occasionally been observed to be so much thickened as to retain nothing of its original peritoneal texture, and to be divisible into layers. But from what I have seen of this disease, I am induced to believe that this opinion has originated from the want of sufficient distinction between the coverings of the sac, and the sac itself; for, as far as I can dis-

Thickened.

a very uncommon variety of the disease. The hernia cystica is described as being equally destitute of this membranous coat; but this is only true in the commencement of the disease.

Dr. Marshall has a preparation of umbilical hernia in which no sac appears, but the protruded parts lie in direct contact with the skin. This variety is very rare; but the possibility of such an occurrence should be known, as in performing the operation for hernia extreme care should on this account be taken, to avoid wounding any of the protruded viscera.

LECTURE XL.

ANATOMY OF THE PARTS FORMING INGUINAL AND FEMORAL HERNIA.

FIVE pairs of muscles with their tendons form the principal covering of the abdomen. These are, on each side, the obliquus externus, the obliquus internus, the transversalis, the rectus, and the pyramidalis. The three first of these only, however, are concerned in the production and course of the two kinds of herniæ in question.

External
oblique.

The external oblique muscles, arising from the eight inferior ribs on each side, slope with an easy descent towards the lower part of the abdomen, and end in an expanded tendon, which covers the whole of the hypogastric and part of the umbilical regions.

This tendinous expansion is provided in man to defend him from the accidents to which his erect attitude would naturally subject him. In quadrupeds, to whom the horizontal position is natural, the weight and pressure of the viscera are diffused over the whole of the abdominal parietes; but in the human subject, when the abdominal muscles and diaphragm are combining their powerful efforts to fix the ribs, to enable the muscles of the upper extremity to act to the greatest advantage, the viscera being forced towards the lower part of the belly, muscular fibre would prove but a

Fig 1



Fig 2

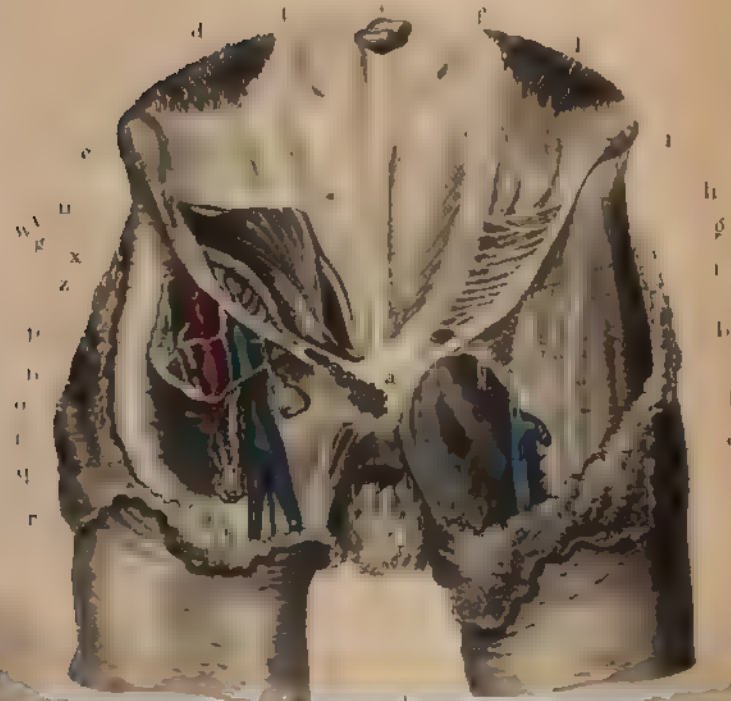


PLATE I.

The first figure in this Plate is intended to shew the insertions of the external oblique muscles, the formation of the abdominal rings, and of two of the fasciæ which are connected with Poupart's ligament, as well as the course of the spermatic cord under the edges of the internal oblique and transverse muscles, before it reaches the abdominal ring.

Fig. 1.

a, Symphysis pubis.

b b, Anterior and superior spinous process of the ilium.

c c, External oblique muscles.

d, Linea alba extending down to the symphysis pubis, and formed by the union of the tendinous fibres of the two oblique and transverse muscles.

e e, Lineæ semilunares, formed by the union of the tendinous fibres of the external and internal oblique and transverse muscles.

f f, The abdominal rings formed by the separation of two columns of tendinous fibres; the upper inserted at *a* into each os pubis; the lower inserted into the pubes at *h*, after passing behind the spermatic cord.

g, The origin of some tendinous fibres which proceed from the anterior spinous process of the ilium, and crossing the columns of tendon, assist in uniting them above the abdominal ring.

i i, Poupart's ligament, or the crural arch, which is extended from the anterior spinous process of the ilium at *b*, to the pubes at *h*, receiving the lower column of tendon, which forms a part of the abdominal ring, and which passes behind the cord to be inserted from the spinous process to the crest of the pubes.

k, The fascia lata of the thigh, which is continued from Poupart's ligament, and seen turning in under the femoral vessels near the middle of the fore part of the thigh.

PLATE I., CONTINUED.

- l*, Is the saphæna major vein of the leg going through the fascia to enter the femoral vein.
- m*, Another part of the same fascia, which arises from Poupart's ligament, and joins with the fascia lata, which it assists in forming.
- n*, The tendon of the external oblique muscle cut open to shew the parts which are situated behind it.
- o*, The internal oblique muscle; its lower edge, which arises from Poupart's ligament, is raised and turned to shew the parts behind it. It is inserted into the pubes behind the upper column of tendon which forms the abdominal ring.
- p*, The transversalis muscle. Its lower edge also arises from Poupart's ligament, but is here raised and turned up. In its natural state it runs over the cord to be inserted into the pubes behind the abdominal ring, which it serves as a valve to close posteriorly.
- q*, A fascia, connected with Poupart's ligament, which runs upwards to the transversalis, and unites itself to the posterior part of the transverse muscle and its tendon, and thus prevents the bowels from slipping between the lower edge of the muscle and Poupart's ligament, or between the fibres of the muscle itself.
- That portion of the fascia which is placed between the spinous process of the ilium at *b*, and the hole *r*, is strong; but that between the hole *r*, and the pubes, is often little more than condensed cellular membrane, as that part is strengthened by the tendon of the transversalis, and by the epigastric artery.
- A portion of the fascia is fixed in the pubes, and another part of it passes behind Poupart's ligament to unite with the femoral vessels.
- r*, The place at which the spermatic cord goes into the abdomen. The fascia situated on its outer side and lower part, is of considerable density, but becoming thin upon its inner

PLATE I., CONTINUED.

side, so as to shew the epigastric artery and vein behind it; from the edge of the fascia a thin layer is sent off which unites itself to the spermatic cord, which fascia in this dissection has been removed.

s, The epigastric artery and vein, situated behind the fascia transversalis, at first on the inner side, and afterwards behind the spermatic cord. The epigastric artery is shewn here by cutting the fascia transversalis parallel to it.

t t, The spermatic cord, nearly two inches of which are above and to the outer side of the abdominal ring, and still not in the abdomen; it is also seen below the ring, running to the testicle.

Fig. 2. This figure is intended to exhibit a view of the abdominal rings, and of the crural arch in the female; the fascia lata of the thigh, the crural sheath, and the passage of the round ligament of the uterus, from the internal to the external ring.

a, Symphysis pubis.

b, Tuberosity of the pubes.

c, Anterior superior process of the ilium.

d d, External oblique muscles.

e, Linea alba.

g, Crural arch, or Poupart's ligament.

h, Tendinous fibres crossing the columns of the external oblique.

i, The abdominal ring on the left side.

k, That part of the fascia lata of the thigh, which proceeds from the crural arch, and which covers the muscles on the outer part of the thigh, and femoral vessels.

l, The inner portion of the fascia lata covering the pectineus and triceps muscles, and united with the outer portion of fascia behind the saphena major vein.

m, Crural sheath cut open.

PLATE I., CONTINUED.

- n**, Femoral artery.
- o**, Femoral vein.
- p**, Three absorbent vessels.
- q q**, The saphena major vein.
- r r**, Two absorbent glands.
- s**, Arteria circumflexa ilii.
- t**, Epigastric artery.
- u**, Tendon of the external oblique muscle laid open.
- v**, Internal oblique turned upwards.
- w**, Transversalis muscle turned upwards.
- x**, Fascia transversalis seen passing from the crural arch behind the transversalis muscle.
- y y y y**, Round ligament of the uterus descending through the opening in the fascia in the inguinal canal.
- z**, Course of the epigastric artery seen through the fascia transversalis.
- +** Absorbent vessels on the left side entering the crural sheath, where crural hernia passes into the thigh.

feeble barrier, and herniæ would probably be the invariable consequence of muscular exertion. This tendon rarely allows an intestine to escape between its fibres; strengthened by an interlacement of texture, it supports the weight of pregnancy and of dropsical accumulations, resists the pressure arising from excessive obesity and from muscular contraction, and would altogether have exempted man from the occurrence of inguinal rupture, were it not for the existence of two openings in it about to be described.

In the lower part of the tendon of each muscle, a little above and to the outer side of the symphysis pubis, is an opening called the abdominal ring, formed for the passage of the spermatic cord to the testicle in the male, and the round ligament of the uterus in the female. The following is the mode in which these openings are produced. Abdominal ring.

The tendon of the external oblique, as it proceeds towards the pubes, splits into two columns, leaving a space for the passage of the spermatic cord: the upper broad column is attached to the symphysis pubis, and crosses its fellow on the opposite side; the lower rounded column, after being doubled under the spermatic cord, is fixed to the process of the pubes, called its spinous process, which may be felt in the living subject; from the under edge of this column, a process of tendon is sent obliquely backwards to the crest of the pubes. Thus it appears that the lower part of the tendon of each muscle has three insertions into the os pubis. First, into the symphysis, by means of the upper column of the ring: secondly, into the spinous process, by the inferior column: and, thirdly, into the crista, or linea ilio-pectinea, by means of a process of tendon called Gimbernat's ligament. *Vide Plate I. and II.*

EXPLANATION OF PLATE FIRST.

This plate is intended to shew the insertions of the external oblique muscles, the formation of the abdominal rings, and of two

of the fasciæ which are connected with Poupart's ligament, as the course of the spermatic cord under the edges of the oblique and transverse muscles, before it reaches the abdominal ring.

- a.* Symphysis pubis.
- b b.* Anterior and superior spinous process of the ilium.
- c c.* External oblique muscles.
- d.* Linea alba extending down to the symphysis pubis, formed by the union of the tendinous fibres of the external oblique and transverse muscles.
- e e.* Lineæ semilunares, formed by the union of the tendinous fibres of the external and internal oblique and transverse muscles.
- f f.* The abdominal rings, formed by the separation of the columns of tendinous fibres; the upper inserted at each os pubis; the lower inserted into the pubic bone after passing behind the spermatic cord.
- g.* The origin of some tendinous fibres which proceed from the anterior spinous process of the ilium, and cross the columns of tendon, assist in uniting them above the abdominal ring.
- i i.* Poupart's ligament, or the crural arch, which is extended from the anterior spinous process of the ilium at *b* to the pubes at *h*, receiving the lower column of tendon, forms a part of the abdominal ring, and which passes behind the cord to be inserted from the spinous process to the crest of the pubes.
- k.* The fascia lata of the thigh, which is continued from Poupart's ligament, and seen turning in under the femoral vessels near the middle of the fore part of the thigh.
- l.* Is the saphæna major vein of the leg going through the fascia to enter the femoral vein.
- m.* Another part of the same fascia which arises from Poupart's ligament, and joins with the fascia lata, which it assists in forming.

The tendon of the external oblique muscle cut open to shew the parts which are situated behind it.

The internal oblique muscle ; its lower edge, which arises from Poupart's ligament, is raised and turned to shew the parts behind it. It is inserted into the pubes behind the upper column of tendon which forms the abdominal ring.

The transversalis muscle. Its lower edge also arises from Poupart's ligament, but is here raised and turned up. In its natural state it runs over the cord to be inserted into the pubes behind the abdominal ring, which it serves as a valve to close posteriorly.

A fascia, connected with Poupart's ligament, which runs upwards to the transversalis, and unites itself to the posterior part of the transverse muscle and its tendon, and thus prevents the bowels from slipping between the lower edge of the muscle and Poupart's ligament, or between the fibres of the muscle itself.

That portion of the fascia which is placed between the spinous process of the ilium at *b*, and the hole *r*, is strong ; but that between the hole *r*, and the pubes, is often little more than condensed cellular membrane, as that part is strengthened by the tendon of the transversalis, and by the epigastric artery.

A portion of the fascia is fixed in the pubes, and another part of it passes behind Poupart's ligament to unite with the femoral vessels.

r. The place at which the spermatic cord goes into the abdomen. The fascia situated on its outer side and lower part, is of considerable density, but becoming thin upon its inner side, so as to shew the epigastric artery and vein behind it ; from the edge of the fascia a thin layer is sent off which unites itself to the spermatic cord, which fascia in this dissection has been removed.

a. The epigastric artery and vein, situated behind the fascia transversalis, at first on the inner side, and afterwards

of the fasciæ which are connected with Poupart's ligament, as well as the course of the spermatic cord under the edges of the internal oblique and transverse muscles, before it reaches the abdominal ring.

- a.* Symphysis pubis.
- b b.* Anterior and superior spinous process of the ilium.
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- e e.* Lineæ semilunares, formed by the union of the tendinous fibres of the external and internal oblique and transverse muscles.
- f f.* The abdominal rings, formed by the separation of two columns of tendinous fibres; the upper inserted at *a* into each os pubis; the lower inserted into the pubes at *h*, after passing behind the spermatic cord.
- g.* The origin of some tendinous fibres which proceed from the anterior spinous process of the ilium, and crossing the columns of tendon, assist in uniting them above the abdominal ring.
- i i.* Poupart's ligament, or the crural arch, which is extended from the anterior spinous process of the ilium at *b*, to the pubes at *h*, receiving the lower column of tendon, which forms a part of the abdominal ring, and which passes behind the cord to be inserted from the spinous process to the crest of the pubes.
- k.* The fascia lata of the thigh, which is continued from Poupart's ligament, and seen turning in under the femoral vessels near the middle of the fore part of the thigh.
- l.* Is the saphæna major vein of the leg going through the fascia to enter the femoral vein.
- m.* Another part of the same fascia which arises from Poupart's ligament, and joins with the fascia lata, which it assists in forming.

The tendon of the external oblique muscle cut open to shew the parts which are situated behind it.

The internal oblique muscle ; its lower edge, which arises from Poupart's ligament, is raised and turned to shew the parts behind it. It is inserted into the pubes behind the upper column of tendon which forms the abdominal ring.

The transversalis muscle. Its lower edge also arises from Poupart's ligament, but is here raised and turned up. In its natural state it runs over the cord to be inserted into the pubes behind the abdominal ring, which it serves as a valve to close posteriorly.

A fascia, connected with Poupart's ligament, which runs upwards to the transversalis, and unites itself to the posterior part of the transverse muscle and its tendon, and thus prevents the bowels from slipping between the lower edge of the muscle and Poupart's ligament, or between the fibres of the muscle itself.

That portion of the fascia which is placed between the spinous process of the ilium at *b*, and the hole *r*, is strong ; but that between the hole *r*, and the pubes, is often little more than condensed cellular membrane, as that part is strengthened by the tendon of the transversalis, and by the epigastric artery.

A portion of the fascia is fixed in the pubes, and another part of it passes behind Poupart's ligament to unite with the femoral vessels.

The place at which the spermatic cord goes into the abdomen. The fascia situated on its outer side and lower part, is of considerable density, but becoming thin upon its inner side, so as to shew the epigastric artery and vein behind it ; from the edge of the fascia a thin layer is sent off which unites itself to the spermatic cord, which fascia in this dissection has been removed.

The epigastric artery and vein, situated behind the fascia transversalis, at first on the inner side, and afterwards

behind the spermatic cord. The epigastric artery is shewn here by cutting the fascia transversalis parallel to it.

- t t.* The spermatic cord, nearly two inches of which are above and to the outer side of the abdominal ring, and still not in the abdomen; it is also seen below the ring, running to the testicle.
-

These columns are united, at the point where they begin to diverge, by cross tendinous fibres, which may be traced from the anterior superior spinous process of the ilium, and from the lower boundary of the tendon called Poupart's ligament. These fibres cross from one pillar to the other, and bind them firmly together, assisted by additional bands passing between the edges of the columns. The direction of these fibres is at right angles with those of the tendon of the external oblique.

Direction.

The direction of the abdominal rings is obliquely upward and outward; for, although they have received the appellation of rings, they are far from being annular in their figure, but approach rather to the triangular form; their longest diameter, which is that from the pubes to the transverse fibres, is about an inch; while their transverse breadth from one column to the other is only half an inch: the centre of the aperture is one inch and a quarter from the symphysis pubis.

Superficial fascia.

A dense cellular fascia is found under the integuments, covering the tendon of the external oblique muscle; it adheres to the edge of the abdominal ring, and accompanies the spermatic cord in its descent into the scrotum, with which latter it is closely connected; it also descends upon the thigh; and, to distinguish it from other structures, I shall call it superficial fascia. It gives a covering to both inguinal and femoral herniæ.

No opening behind the ring.

The direct passage of the spermatic cord into the cavity of the abdomen is prevented by tendons and a fascia, which are probably intended as a guard against protrusion of the contents of the belly.

The tendons that close the opening, are those of the internal oblique and transversalis muscles.

Behind the tendon of the external oblique, the lower fibres of the obliquus internus take their course; those from the spine of the ilium horizontally towards the linea semilunaris and alba, while those which arise from the outer half of Poupart's ligament are passing obliquely towards the pubes. The lower fibres, after passing over the spermatic cord, terminate in a tendon, which is inserted into the symphysis pubis. If the finger be passed through the ring, this tendon may be felt immediately above it, and towards its inner side. Internal oblique.

The lower portion of the transversalis runs nearly parallel to the former, but arises only from one third of Poupart's ligament; passing underneath, and concealed by the internal oblique, the fibres also cross the spermatic cord, and end in a tendon, which is connected with that of the latter muscle, and is inserted into the linea alba and pubes. But the tendon of the transversalis descends much lower than that of the internal oblique; and towards the pubes and Gimbernat's ligament, forms a semilunar expansion, which is connected with a fascia presently to be described; it is more particularly by the union of these that the abdominal ring is closed behind. *See Plate II.* Transversalis.

The foregoing description will shew that there is no natural aperture into the abdomen behind the ring; and therefore the opening, by which the spermatic vessels quit the abdomen, must be sought for elsewhere. It will be found one inch and a half above, and to the outer side of the abdominal ring, in a line passing from the ring to the superior spinous process of the ilium. This line marks the course of the spermatic cord; and the opening, which allows its immediate exit from the abdomen, is formed in a fascia, to understand the nature of which, Poupart's ligament and its fasciæ must be more particularly described.

Poupart's ligament, or, as it is now commonly called, the crural arch, is a rounded band of tendon connected to the superior spinous process of the ilium, whence it passes down in a vaulted

of the fasciæ which are connected with Poupart's ligament, as well as the course of the spermatic cord under the edges of the internal oblique and transverse muscles, before it reaches the abdominal ring.

- a.* Symphysis pubis.
- b b.* Anterior and superior spinous process of the ilium.
- c c.* External oblique muscles.
- d.* Linea alba extending down to the symphysis pubis, and formed by the union of the tendinous fibres of the two oblique and transverse muscles.
- e e.* Lineæ semilunares, formed by the union of the tendinous fibres of the external and internal oblique and transverse muscles.
- f f.* The abdominal rings, formed by the separation of two columns of tendinous fibres; the upper inserted at *a* into each os pubis; the lower inserted into the pubes at *h*, after passing behind the spermatic cord.
- g.* The origin of some tendinous fibres which proceed from the anterior spinous process of the ilium, and crossing the columns of tendon, assist in uniting them above the abdominal ring.
- i i.* Poupart's ligament, or the crural arch, which is extended from the anterior spinous process of the ilium at *b*, to the pubes at *h*, receiving the lower column of tendon, which forms a part of the abdominal ring, and which passes behind the cord to be inserted from the spinous process to the crest of the pubes.
- k.* The fascia lata of the thigh, which is continued from Poupart's ligament, and seen turning in under the femoral vessels near the middle of the fore part of the thigh.
- l.* Is the saphæna major vein of the leg going through the fascia to enter the femoral vein.
- m.* Another part of the same fascia which arises from Poupart's ligament, and joins with the fascia lata, which it assists in forming.

the outer portion of the fascia above the cord, being at length firmly fixed in the pubes; the inner margin of the ring is less defined than the outer, the fascia transversalis being doubled inwards towards the peritoneum, to which it is firmly attached. Thus, then, it appears, that the *internal ring* is not a circumscribed aperture like the external abdominal ring, but is formed by the separation of two portions of fasciæ, which have different attachments and distributions at the crural arch; the outer portion terminating in Poupart's ligament, while the inner portion will be found to descend behind it, to form the anterior part of the sheath that envelopes the femoral vessels. The strength of this fascia varies in different subjects; but in all cases of inguinal hernia it acquires considerable strength and thickness, especially at its inner edge; and if these parts had been formed without such a provision, the bowels would, in the erect posture, be always capable of passing under the edge of the transversalis muscle, and no person would be free from inguinal hernia. *Vide Plate II.*

The fascia transversalis may be traced as high as the diaphragm; and on the inner side it passes behind the rectus muscle, where it begins to assume the character of cellular tissue.

Through the two openings which I have described, the spermatic cord passes down to the testicle. The cord is composed of arteries, veins, nerves, absorbents, an excretory duct called the vas deferens, a membranous sheath, and the cremaster muscle. Spermatic cord.

The spermatic artery on each side is derived from the fore part of the aorta, below the origin of the emulgent arteries. It passes down behind the peritoneum over the psoas muscle, and, crossing the ureter, arrives at the internal ring, where it forms part of the spermatic cord. Artery.

The spermatic vein on each side arising from the testis, enters the abdomen with the cord, and accompanies the artery to the middle of the abdomen, where they separate; the right vein terminating in the inferior cava, the left joining with the left emulgent vein. Vein.

The vas deferens commences from the under and back part of Vas deferens.

the epididymis, forming with the latter the excretory duct of the testis; it accompanies the cord to the internal ring, and there leaving the spermatic vessels, descends over the brim of the pelvis by the side of the bladder to its ultimate destination in the urethra. The duct is frequently accompanied by a small artery derived from a branch of the internal iliac.

Tunica vaginalis.

These vessels, together with the accompanying nerves and absorbents, receive a double covering of peritoneum, which is derived from the part at which they quit the abdomen, and closely unite them together. This covering is called the tunica vaginalis of the spermatic cord. About an inch above the testis, the two layers separate to form a serous bag, which invests the gland anteriorly, and gives freedom to its motion. This bag is called the tunica vaginalis testis.

Cremaster.

Between the upper and lower rings the cord receives the cremaster muscle. It arises, under the tendon of the external oblique muscle, from the edges of the internal oblique and transversalis, descends into the scrotum upon the surface of the cord, and is attached to the tunica vaginalis reflexa of the testicle. This muscle is usually accompanied in its descent into the scrotum by a branch from the epigastric artery.

It appears, therefore, that the portion of the cord between the testis and the external ring is covered by a double peritoneal coat, formed by the tunica vaginalis, next by the cremaster muscle, and lastly by a layer of fascia sent from the tendon of the external oblique; that portion included between the two abdominal rings is also covered by the cremaster and tunica vaginalis; but, besides the fascia of the external oblique, it receives an additional covering from the tendon of the muscle. Within the cavity of the abdomen the spermatic vessels receive no other covering but that which is derived from the peritoneum.

Inguinal canal.

The space which the cord occupies between the external and internal abdominal rings is now called the inguinal canal. It is formed by the following parts: the posterior boundary is formed by the union of the tendon of the transversalis muscle and fascia

transversalis. Below, the canal is completed by the crural arch, and anteriorly it is bounded by the tendon of the external oblique. This canal seems to answer the purpose of preventing the ready protrusion of the abdominal viscera; for, had the cord emerged from the abdomen immediately behind the external ring, few persons in the habit of much bodily exertion would be free from hernia; whereas, when the abdominal muscles are in action, the tendon and fascia behind the cord being pressed forward by the viscera, perform the part of a valve, and more completely shut up the passage against the descent of the viscera.

The epigastric artery is situated so near to the spermatic cord, and is so much concerned in the operation for hernia, that a most accurate knowledge of its course is absolutely requisite. This vessel arises from the external iliac artery behind Poupart's ligament, and, after a slight inclination downwards, passes upwards and inwards. At its commencement it is situated behind the fascia transversalis, and runs along the inner edge of the internal ring, where the spermatic cord crosses it nearly at right angles; taking its course behind the edge of the rectus, it enters the sheath of the latter muscle, and ascends to inosculate with the internal mammary artery. In its course it distributes a branch to the cremaster, which descends on the cord, and also several to the abdominal muscles; it is also generally accompanied by two veins. Where the epigastric artery is crossed by the cord, it is distant about three inches from the symphysis pubis on one side, and from the superior spinous process of the ilium on the other.

Epigastric artery.

STRUCTURE OF THE PARTS FORMING FEMORAL HERNIA.

In order to understand the parts directly and indirectly concerned in this intricate part of anatomy, and to comprehend the means that nature has adopted to give security to the contents of the abdomen at the upper part of the thigh, it will be necessary to describe the anatomy of the bones, and of the different fasciæ, which are formed at the groin.

Bones.

The distance between the symphysis pubis and the anterior superior spinous process of the ilium, is from five and a half to six inches, and if a line be drawn from one of these points to the other, the space beneath it will be bounded for half its length by the body of the pubes, and half by the ilium. About an inch and a quarter from the symphysis pubis, (in the dried bone,) upon its anterior and upper part, is situated the tuberosity of the pubes, or, as it has been improperly called, its spinous process. From this process a line is seen to extend obliquely backward and outwards along the upper part of the pubes, as far as its junction with the ilium; this line is called the *linea ilio-pectinea*, and assists in forming the brim of the pelvis.

About an inch and a quarter on the outer side of the tuberosity of the pubes, is a natural depression on the upper part of the bone, formed for the lodgement of the femoral artery, vein, and absorbents, which, upon its outer side, is bounded by a projection, marking the junction of the os pubis and ilium, and extending over the acetabulum.

On examining that part of the ilium which forms the outer boundary of the space mentioned above, it will be found, that two inches below the anterior superior spinous process, is situated another similar projection, called the anterior inferior spinous; and, that between the two, is a depression about an inch and a quarter in extent; immediately below the latter process is the acetabulum, and an inch anterior to it, is a flat surface extending to the os pubis.

It will be seen on dissecting the soft parts that fill up the space between the ilium and pubes, that they are wonderfully and beautifully adapted to the purpose for which they are designed; but it must be acknowledged, that their intricate connections render them of all parts in anatomy the most difficult to investigate, and to describe with perspicuity.

Ligament of the pubes.

The os pubis is covered by a ligamentous expansion, which forms a remarkably strong production above the *linea ilio-pectinea*, extending from the tuberosity of the pubes outwards, and projecting

from the bone over that line. To this ligament the third insertion of the external oblique muscle, or, as it is commonly called, Gimbernat's ligament, is attached. To obtain a clear view of it in dissection, the fascia covering the pectineus muscle, together with the muscle itself, must be cut away.

The superficial fascia, which, in the anatomy of inguinal hernia, was described as covering the external oblique tendon, and descending into the scrotum over the cord, is found to have a very firm attachment to the lower edge of the crural arch; from thence it descends upon the absorbent glands of the groin, where it has been said to terminate; but erroneously, as it passes down upon the thigh, giving a covering to the absorbent vessels and superficial veins. The strongest fibres of this fascia are transverse; and though in its natural state it may readily escape the attention of the anatomist, yet, when it has been long pressed upon by a hernial tumour, particularly in a subject loaded with fat, it acquires considerable density. The covering which this gives to the femoral hernial sac, with the attachment it has to the edge of the crural arch, will be seen in the plates of the second part. Superficial fascia.

In a former part of the anatomical description it was mentioned, that Poupart's ligament gave origin to three fasciæ; one of the three which descends upon the thigh, and possesses great strength, is called *fascia lata femoris*. It may be said to have two distinct origins or attachments. The outer part, which is the stronger, arises from the whole of the lower edge of the crural arch, crossing the femoral artery and vein, the psoas and iliacus muscles, and the anterior crural nerve. The inner portion arises from the os pubis and the ligament of the pubes at the insertion of Gimbernat's ligament, extends over the pectineus and triceps muscles, and unites with the outer portion under the vena saphæna major. The united portions then form the fascia lata, which extends down the thigh, to envelop the muscles and support them when in action. Fascia lata.
Vide Plate II., Fig. 3.

When this fascia is first laid bare, the outer portion appears to

Fascia transversalis.

be turned in under the femoral artery and vein ; but, on further dissection, is found to form a sharp crescentic edge, which has been well described by Mr. Allan Burns, and is called by him the *falciform process*. This falciform edge is connected to the fore part of the sheath containing the femoral vessels, and serves to strengthen it. When this fascia is dissected away, the muscles on each side are exposed, and the anterior crural nerve is laid bare ; but the femoral artery and vein still remain enclosed in a sheath. The anterior part of this sheath appears at first sight to arise from the crural arch, but it may be readily detached from it by passing the finger behind the arch, where it will be found to be a continuation of the inner portion of the fascia transversalis. In a former part of the description it appeared, that this fascia consisted of two portions ; one, arising from the whole of the upper edge of the crural arch, ascends under the transversalis muscle, and forms the outer edge of the internal abdominal ring ; while the inner portion, fixed by a firm attachment to the pubes, passes behind the tendon of the transversalis muscle, with which it is blended, and forms the floor of the inguinal canal. Through the inner side of the sheath next to the pubes, pass the femoral absorbent vessels into the abdomen ; in the male subjects I have seen them enter the sheath in a cluster, through a single hole in this fascia ; but in both sexes the fascia is generally rendered cribriform by these vessels passing through a variety of small openings ; but, nevertheless, if the sheath be clearly dissected, and the finger thrust into it from the abdomen, the cellular membrane and absorbent vessels are protruded through one of these holes which is larger than the rest ; some of the absorbents also pass between the artery and vein, and in some subjects even on the outer side of the artery, entering by two small openings in the anterior part of the sheath. *Vide Plate II.*

OF THE PARTS WHICH SHUT THE ABDOMEN FROM THE THIGH.

When the peritoneum is dissected from the posterior surface of

the abdominal muscles, from the symphysis pubis to the spinous process of the ilium, the space between these points of bone will be found to be occupied in the following manner:—

From that part of the crural arch extending between the anterior superior spinous process of the ilium, to the outer edge of the external iliac artery, a strong fascia will be found to arise, extending upwards over the iliacus and psoas muscles; it may be traced inwards behind the femoral vessels, as far as the linea iliopectinea, being attached at that line to the ligament of the pubes, and to the tendon of the psoas parvus, when that muscle is present. This fascia has been particularly described by Gimbernat, and should be called fascia iliaca. If the fascia iliaca be carefully traced, it will be found to arise from the outer half of the crural arch, in conjunction with the outer portion of the fascia transversalis, the latter ascending before the peritoneum, while the former passes up behind that membrane; they unite at the outer side of the transversalis muscle, and appear as one continuous production. By the union of these two fasciæ at Poupart's ligament, and their separation to inclose the viscera, the contents of the abdomen are thus received into a blind funnel, and are prevented descending on the outer side of the iliac vessels. If the latter vessels be raised, the fascia iliaca will be seen descending behind them, as far down the thigh as the origin of the arteria profunda, thus forming the posterior part of the sheath. *Vide Plate II.*

Thus a sheath is formed, enveloping the femoral artery, vein, and absorbent vessels, anteriorly by the descent of the fascia transversalis, posteriorly by a similar process from the fascia iliaca: and by the union of these at the inner and back part of the sheath the bag is rendered complete. At the upper part the sheath is broad, but as it descends, it becomes more closely applied to the femoral vein and artery, giving it the appearance of a funnel, as is seen in the plate. It is at the upper and inner part of this funnel that the absorbent vessels enter the sheath, giving it, as has been already remarked, a cribriform appearance; this part of the sheath

is much looser in its texture than the portion investing the artery and vein, which is firm and unyielding.

Contents of the sheath.

If the sheath be opened, the contents will be found separated by two membranous septa, one passing between the artery and vein, and a second, equally distinct, between the vein and the absorbents; the septum is formed by a process from the fascia transversalis passing backward, to attach itself to the fascia iliaca. The contents of the sheath differ in their attachment to the bag; the artery and vein are seen completely filling up the space in the sheath which is allotted to them; while the absorbents are loosely connected by means of cellular membrane and fat, which, not affording sufficient resistance to the pressure of the abdominal viscera, occasionally allows the descent of a hernia. *Fig. 2. Plate II.* It is this opening in the inner part of the sheath, occupied by the absorbent vessels and cellular membrane, to which the term *femoral aperture*, as allowing the descent of a hernia, should be strictly applied. This aperture is situated between the lunated edge of Gimbernat's ligament and the inner side of the femoral vein. When viewed from the abdomen, after the peritoneum is removed, it appears filled with cellular texture, which, being elastic, readily allows the finger to pass for an inch below the crural arch. If the finger be pressed forwards against the arch, the posterior edge of the latter may be distinctly felt; and even when Poupart's ligament is cut away, a tendinous unyielding band will be felt on the fore part of the sheath, where the latter is united to Poupart's ligament. The opening which allows the passage of the iliac vessels under Poupart's ligament is necessarily large, and can only be seen by removing the whole of the vessels, together with their sheath. The opening then appears to be of an irregularly oval shape, extending from the outer edge of Gimbernat's ligament to the junction of the fascia iliaca with the crural arch, and is bounded behind by the os pubis and its ligament, and before by the posterior edge of the crural arch. Its figure and boundaries will be seen delineated in *Plate II.*

Femoral aperture.

The epigastric artery, in its course to the rectus muscle, is distant from the femoral aperture, by which the absorbents enter, not more than three quarters of an inch. This vessel is subject to considerable variety in its origin; for, though it generally arises near the orifice of the sheath, it not unfrequently takes its origin an inch below its usual place; and, under this variety, approaches much nearer to the mouth of a hernial sac. When the thigh is extended, this vessel is drawn down into the sheath. The spermatic cord in the male, and the round ligament of the uterus in the female, entering the internal abdominal ring on the outer side of the epigastric artery, descend obliquely along the inguinal canal; in their course the cord is separated from the femoral aperture by the fascia transversalis, which lies immediately above that opening and the crural arch. The proximity of the cord to the mouth of a femoral hernial sac should be borne in mind.

Epigastric artery.

The arteria circumflexa ilii arises from the external iliac artery, nearly opposite to, but a little below, the epigastric artery; and passing into a groove, formed by the common origin of the fascia iliaca and transversalis, it is continued towards the inner part of the superior spinous process of the ilium.

Arteria circumflexa ilii.

The vena saphæna major enters the crural sheath about an inch below the crural arch, and terminates on the inner side of the femoral vein.

Vena saphæna major.

The difference in the structure of these parts in the male and female, which chiefly conduces to the production of hernia, is well explained by Dr. Monro, Jun., in his "Observations on Crural Hernia." The oval space forming the orifice of the crural sheath is larger in women than in men. The distance from the spine of the ilium to the symphysis pubis is greater, and, consequently, the crural arch is wider. The third insertion of the external oblique muscle is not so deep in the male as in the female. The psoas and iliacus internus occupy less space in the female than in the male. I have generally found this disease in women who have a very large pelvis in whom the ilium and pubes project more than usual.

Difference of structure in the male and female.

The following measurement of the parts I have described was

Measurement.

made from subjects, which appeared to be well formed; and although the precise distance will vary according to the size of the person, the relative proportion of the parts will be preserved.

MALE.

	Inches.
Symphysis pubis to the anterior superior spinous process of the ilium	5 3-4ths.
————— to the tuberosity of the pubes	1 1-8th.
————— to the inner margin of the external abdominal ring	0 7-8ths.
————— to the inner edge of the internal abdominal ring	3
————— to the middle of the iliac artery	3 1-8th.
————— to the middle of the iliac vein	2 5-8ths.
————— to the origin of the epigastric artery	3
————— to the epigastric artery on the inner edge of the internal abdominal ring	2 3-4ths.
————— to the middle of the lunated edge of the fascia lata	3 3-4ths.
————— to the middle of the crural ring	2 1-4th.
Anterior edge of the crural arch to the saphæna major vein	1

FEMALE.

Symphysis pubis to the anterior superior spinous process of the ilium	6
————— to the tuberosity of the pubes	1 3-8ths.
————— to the inner margin of the external abdominal ring	1
————— to the inner edge of the internal abdominal ring	3
————— to the middle of the iliac artery	3 3-8ths.
————— to the middle of the iliac vein	2 3-4ths.
————— to the origin of the epigastric artery	3 1-4th.

	Inches.
Symphysis pubis to the epigastric artery on the inner edge of the internal abdominal ring	2 7-8ths.
————— to the middle of the lunated edge of the fascia lata	2 3-4ths.
————— to the middle of the crural ring	2 3-8ths.
Anterior edge of the crural arch to the vena saphæna	1 1-4th.

[I am indebted to the kindness of R. D. Granger, Esq., Professor of Anatomy at the Webb-street School, for the following method of dissecting the parts forming hernia. ED.]

BEFORE proceeding to the dissection of the parts connected with hernia, it is necessary to examine the external configuration of the abdomen, and to consider how far the structure of that cavity may influence the protrusion of its contents. In making this examination reference must be had to the influence of position; for it is evident, that as the upright posture is that in which the viscera escape, we shall acquire only very imperfect ideas of the conformation of the abdomen, if the body be merely regarded when placed, as it is, for the purposes of dissection, supine. If then we observe the erect body in profile, it will be seen that in consequence of the projection of the lumbar vertebræ, the axis of the abdomen is thrown obliquely forward, whilst that of the pelvis recedes; so that the contents of the former cavity are necessarily inclined against the anterior and lower part of the parietes, or in other words, against that particular part of the abdominal walls, where, from the existence of certain apertures, the resistance is least. This natural prominence of the abdomen is remarkably increased in obesity; and this alteration is one among the other changes attendant on that state, which predisposes to the formation of hernia.

We may next remark that the division between the abdomen

and the thigh is marked out by the depression which corresponds to Poupart's ligament, (the crural arch,) which structure may be readily traced in its whole extent between the anterior spine of the ilium and the tubercle of the pubis.

In order to expose the structures more immediately connected with inguinal hernia, it is necessary to make a perpendicular incision commencing at the umbilicus and terminating at the symphysis pubis; from the upper end of this incision a second may be carried outward to the crest of the ilium, and in this manner a triangular flap will be marked out which should be carefully raised, recollecting, that, in the first instance, the skin only should be taken up, leaving the superficial fascia perfect and entire. Having thus exposed the fascia superficialis abdominis, the manner in which that important structure strengthens the lower wall of the abdomen should be observed. In common with all other parts of the body, it covers the whole surface of the abdomen; it is continued over Poupart's ligament into the groin, and an important process descends into the scrotum, covering the spermatic cord, and at length proceeding perfectly continuous with the superficial fascia of the perinæum. The superficial fascia being provided to afford an uniform support in all parts of the body, is endowed with the necessary degree of strength and elasticity; but its thickness and resistance are much greater where it covers the abdomen and thigh than elsewhere.

In those situations it is particularly necessary to remark, that it presents a laminated texture, so that, by proceeding carefully, several successive layers may be raised and divided. In this stage of the dissection the variable thickness of the fascia as to the quantity of fat contained in its substance, and its degree of resistance in different subjects, should be noticed. The superficial blood-vessels of the abdominal parietes are lodged in the substance of the fascia; they consist of the superficial circumflex of the ilium, the superficial epigastric, and the external pudic arteries. The student will observe that some of these vessels, especially the latter, are so placed with respect to the external ring, and the

nous opening of the fascia lata, that they are very liable to be divided in the operation for inguinal and femoral hernia, as well as that of castration.

The superficial fascia is to be completely raised by dividing it in a manner to the skin; but as it is desirable again to examine the part, it should not be cut away, but turned down towards the

In raising the fascia it will be perceived that it is but loosely connected by lax cellular substance to the tendon of the external oblique, excepting around the margins of the external ring and in the course of Poupart's ligament, in which situations a firm connection is established by means of some processes of fascia.

The surface of the external oblique muscle being thus exposed, it will be seen that it consists of an expanded sheet of tendon, which covers the whole anterior and lower part of the abdomen. The fibres which run obliquely downwards and forwards, begin to divide at a short distance below the anterior spine of the ilium into fasciculi, of which the upper passes to be inserted into the anterior and superior part of the pubic symphysis, and the lower into the tubercle of the pubis. The opening left between these fasciculi is the external abdominal ring, and the fasciculi themselves are called the pillars or columns of the ring.

Tendon of the external oblique.

The external ring is then nothing more than an opening in the middle of the external oblique placed between the symphysis and the tubercle of the pubis, which in the male transmits the spermatic cord, and in the female the round ligament of the uterus. The borders, formed of the above mentioned fasciculi, offer considerable resistance when an attempt is made to separate them, not only on account of their thickness, but in an especial manner in consequence of their being firmly united by a structure which is called the *intercolumnar fascia*. In order to strengthen the walls and to prevent the separation of the parallel fibres of the external oblique, it will be observed, that at the lower part of the abdomen additional tendinous fibres are provided, which pass as the former in a semicircular manner from above Poupart's ligament towards the linea alba. Now where these fibres ap-

External ring.

Intercolumnar fascia.

proach the outer angle of the external ring, they assume the form of a fascial membrane; and this membrane interposed between the pillars of the ring, and joining them firmly together, is the intercolumnar fascia.

External spermatic fascia.

When the superficial fascia is first raised, the borders of the external ring are not distinctly seen, in consequence of a process of fascia being continued from the pillars of the ring on to the surface of the spermatic cord, called the *external spermatic fascia*. This structure extends into the scrotum, where it is lost in the expansion of the cremaster. It is desirable to leave this fascia entire on one side of the subject, and to remove it on the other, in order to examine more carefully the form and relations of the external ring.

External ring is closed towards abdomen.

Before the tendon of the external oblique is divided, it is very important to ascertain how the external ring is closed towards the abdominal cavity, or in other words how the direct protrusion of the viscera, is prevented. If the student endeavour to push his finger through the ring towards the cavity, he will find that it is obstructed by a firm ligamentous structure. This consists, 1. Of the *fascia pyramidalis*, a small portion of fascia, which is derived from the tendon of the opposite external oblique, and is inserted into the os pubis behind the external ring. 2. Of the united tendon of the internal oblique and transversalis, which is attached to the linea-ilio-pectinea. It is also necessary to remark that behind this common tendon, there is the fascia transversalis; so that the viscera are supported at the external ring—by 1. the common integuments, consisting of the skin and superficial fascia; 2. the external spermatic fascia; 3. the pyramidal fascia; 4. tendon of internal oblique and transversalis; 5. fascia transversalis.

The next stage of the dissection consists in dividing the tendon of the external oblique in the same way as the integuments, taking care that the perpendicular incision is continued completely down to the symphysis pubis; this will allow the triangular flap to be sufficiently turned towards the groin to expose the parts beneath.

The internal oblique is now seen proceeding from the outer end of even two-thirds of Poupart's ligament in a curved direction outwards and inwards towards the pubis, where behind the external ring it is inserted. In this course the muscle describes an arch principally formed of fleshy fibres, although on the inner side it is tendinous. This arch crosses the spermatic cord at the distance of about an inch on the iliac side of the external ring; so disposed that whilst the internal oblique, at its attachment to Poupart's ligament, is anterior to the cord, the part of the muscle towards its insertion in the pubis, is behind the cord.

Internal oblique
and transversalis.

The transversalis observes very nearly the same disposition, differing only in that its origin is confined to about the outer third of Poupart's ligament.

The student will now observe the cremaster muscle, investing the spermatic cord. The fibres pass off partly from the muscular arch of the internal oblique, partly from Poupart's ligament, and partly from the inner side, from the tendon of the internal oblique behind the external ring. The cremaster thus arising by a long external and short internal origin, consists of pale brownish fibres, which, with their connecting cellular tissue, constitutes a kind of sheath for the spermatic cord. This investment is continued into the scrotum, where, in a favourable subject, the fibres may be seen open, and describe large curves over the testicle, being especially inserted into the prolongation of the fascia transversalis. If the body be thin and emaciated, the cremaster is very distinct, particularly at its insertion.

Cremaster.

Having proceeded thus far, the internal oblique and transversalis are to be detached from Poupart's ligament, but it is important to bear in mind that the muscular arch across the cord and the tendon behind the external ring, are to be left intact. In performing this part of the dissection, care must also be taken not to disturb the fascia transversalis, which, from its connection with the common tendon of the two muscles, is very liable to be divided.

We now arrive at that ligamentous membrane which, beneath

Fascia transversalis.

the muscles, lines the whole interior wall of the abdomen; it is named the *fascia transversalis*.

We shall in this place merely consider the relations of the *fascia transversalis* with the parts of inguinal hernia; deferring its connections with the *fascia iliaca* and crural sheath, till the anatomy of femoral hernia is described. The *fascia transversalis* is attached to the whole length of Poupart's ligament, that is to say, from the anterior superior spine of the ilium, as far as the tubercle of the pubis. It then passes upwards, beneath the transverse muscle, over the peritoneum, as far as the cartilage of the ribs, thus covering the whole anterior wall of the abdomen; but being much stronger below, where the greatest support is required, than above, where, indeed, it degenerates into cellular tissue, but still preserving the form of a membrane, it may by care be dissected from the peritoneum as a separate and distinct layer, as high nearly as the diaphragm.

Internal ring.

At the distance of nearly an inch from the crural arch, it will be observed that the spermatic cord is connected with the *fascia*; this connexion, which is very intimate, has been variously described by writers. Sir A. Cooper, who first discovered this *fascia* as a separate part of the abdominal parietes, has, in his splendid plates, represented it as consisting of two portions—an outer or iliac portion, and an inner or pubic; between these two parts an elliptical shaped opening being left, called the *internal abdominal ring*. A careful examination will show, however, that there is no actual opening or perforation of the *fascia transversalis* at the internal ring; on the contrary, it is evident that at the point where the spermatic cord quits the abdominal cavity to pass through the parietes, it carries with it a tube-like process of the *fascia*, which process, wide above and becoming contracted below, so as closely to embrace the cord, extends with that structure into the scrotum; and there, again enlarging, it completely invests that covering of the testicle which is called *tunica vaginalis reflexa*. What, then, is known as the internal ring, is in fact

nothing else than the mouth of that infundibular process of the fascia, which accompanies and surrounds the cord. The internal ring is situated, according to Sir A. Cooper, midway between the anterior superior spine of the ilium and the symphysis of the pubis; but it appears in general to be placed in the mid space between the precise point of the tubercle of the pubis. It is rather less than two inches to the outer or iliac side of the external ring, and about an inch above Poupart's ligament, and is covered towards the external surface by the integuments, the tendon of the external oblique, and by the fleshy origin of the internal oblique and transverse muscles, whilst behind or towards the abdominal cavity, it is closed by the peritoneum.

That process of the fascia transversalis which accompanies the spermatic cord, has received various names; it has been called *fascia canalis inguinalis* and *f. infundi triliformis*; but as it immediately invests the cord, it may be properly called *f. spermatica interna, vel propria*. The structure thus constituting a sheath around the cord, must necessarily be separated from that part by the descent of an oblique hernia; and as the sheath extends into the scrotum, the hernial sac will be closely covered in its whole extent by this prolongation of the fascia transversalis; and thus it happens that in old and voluminous hernia, as well as in recent protrusions, there is no difficulty, by a careful dissection, in separating from the true peritoneal sac, the fascial investment to which we have been referring.

Fascia spermatica interna vel propria.

It is necessary to remark, that the fascia transversalis not only furnishes a sheath, accompanying the spermatic cord into the scrotum; but it likewise sends a process on the spermatic blood-vessels into the abdominal cavity.

The space which extends from the internal to the external ring, is named *canalis inguinalis*; this passage, which runs obliquely downwards, inwards, and forwards, is hollowed in the substance of the abdominal walls, being bounded on the fore part by the skin, the superficial fascia, the tendon of the external oblique, and by the fleshy origin of the internal oblique and transver-

Inguinal canal.

salis; whilst, on the back part, it is bounded by the united tendon of the internal oblique and transversalis, and by the fascia transversalis. Its length is about two inches. In considering the parts which form the walls, it is most important to take into the account the internal, oblique, and transversalis; because those muscles are so disposed as to form the inguinal canal into a true muscular passage, by which means the viscera of the abdomen are supported at the internal ring, at the precise time when support is required, namely, during great muscular exertions.

Spermatic cord.

The student should now notice the courses and relations of the cord. This important structure quits the abdominal cavity at the internal ring; it passes downwards and forwards, following the course of the inguinal canal, in which it is lodged, till it reaches the external ring; it passes through the outer part of that opening, and then turning suddenly down, it runs into the scrotum. In this course it will be found that having, at the internal ring, received the covering of the fascia spermatica interna, it next passes beneath the fleshy arch, formed by the internal oblique and transversalis, where it receives the fibres of the cremaster muscle. As it passes through the external ring, it acquires the fascia spermatica externa, and also the covering of the fascia superficialis and skin.

Epigastric arteries.

By cautiously dividing the fascia transversalis, just on the pubic side of the internal ring, the epigastric blood-vessels will be brought into view, surrounded by a quantity of lax cellular tissue and fat, and lying on the peritoneum. These consist of the artery placed in the middle, and of two accompanying veins, of which the one next to the pubis is usually the largest. The epigastric artery, arising from the external iliac muscle, first of all runs downwards, but very soon altering its course it passes upwards and inwards, towards the edge of the rectus muscle, so as to describe an arch around the great cul de sac formed by the peritoneum in the neighbourhood of the crural arch. In the course described, the vessel passes behind the inguinal canal and spermatic cord, nearly at a right angle, being separated from those parts by the fascia transversalis; it is placed between the two ab-

nal rings, being on the iliac side of the external ring, and on the pubic side of the internal ring.

We are now prepared to trace the course and relations of the oblique inguinal hernia. This, which is by far the most common species of rupture, passes, in the first instance, through the internal ring, and as that part is closed towards the abdomen by the peritoneum, it is evident that the latter structure must be pushed before the viscera, so as to form the envelope or *sac* in which they are contained. At the internal ring the hernia separates from the cord on which it descends, the internal spermatic artery; it then passes beneath the muscular arch of the internal oblique transversalis, and in this place it detaches the fibres of the cremaster from the surface of the cord; continuing to descend, the protrusion escapes from the inguinal canal by passing through the external ring, where it gets the coverings of the external spermatic fascia, the superficial fascia, and the skin. The hernia subsequently continues its descent, until it has passed completely beneath the scrotum. In this course, enumerating the parts, according to the order in which they are divided in the operation, the hernia is covered by 1st, the skin; 2dly, superficial fascia; 3dly, external spermatic fascia; 4thly, cremaster muscle; 5thly, internal spermatic fascia. It is proper to remark, that although these several layers can be distinctly demonstrated to exist, yet that after protrusion has occurred some time, they are generally, in consequence of the process of chronic inflammation that is set up, so thickened and blended together, that they are separated with difficulty; and especially it happens that the external spermatic fascia becomes blended with the cremaster, and the internal with the peritoneal sac.

Course and coverings of oblique inguinal hernia.

We have already pointed out the means adopted by nature to prevent the direct protrusion of the viscera at the external ring. Although the support thus afforded is in the great majority of cases efficient, yet it occasionally happens that a hernia is formed, which, passing neither through the internal ring nor the inguinal passage, emerges directly through the external ring; such

Direct inguinal hernia.

a protrusion is therefore called a direct inguinal hernia. The opportunity of dissecting this species of rupture but seldom occurring, our knowledge of its exact anatomical relations is in some respects imperfect. It is certain, however, that the sac passing forward, carries before it the internal or pubic part of the fascia transversalis; and that then it either pushes in front of it the united tendon of the internal oblique and transversalis, or that tendon gives way, and thus allows the hernia to pass through its substance. In two specimens of this hernia which I have dissected, the protrusion appeared to have passed beneath the united tendon; and from this circumstance, joined to the fact that the lower part of that tendon is occasionally deficient, I am inclined to think that in most, if not in all of those cases in which it has been stated that the tendon was ruptured, the hernia had in reality passed under the tendon. The rupture subsequently takes its course through the external ring, having the end on the outer side; it then descends into the scrotum. The coverings of the direct hernia are, 1. the skin; 2. the superficial fascia; 3. the external spermatic fascia; 4. occasionally, but seldom, the cremaster muscle; 5. sometimes, yet not constantly, the united tendon of the internal oblique and transversalis; 6. the fascia transversalis.

Relation of the epigastric artery to the two varieties of hernia.

From the account which has been given, it is evident that as the epigastric artery is placed between the two abdominal rings, that is to say, on the iliac side of the external, and on the pubic side of the internal ring, it must happen that this important blood-vessel is situated on the inner side of the mouth of the sac in the oblique hernia, and on the outer side of the mouth of the sac, in the direct hernia.

THE DISSECTION OF FEMORAL HERNIA.

Femoral hernia.

In order to expose the parts connected with the anatomy of femoral hernia, it is necessary to make two superficial incisions,—one commencing at the spine of the pubis and extending about

inches in a perpendicular direction downwards; the other ending at the anterior superior spinous process of the ilium, terminating at the upper extremity of the former. On dissecting back the flap thus formed, you expose to view the fascia *fascia superficialis*; which structure, after covering the abdominal muscles, descends over Poupart's ligament to invest the muscles of the lower extremity. In the groin this fascia is stronger than it covers the abdominal muscles, and may be divided into layers, which are separated from each other by lymphatic vessels, and the superficial inguinal blood-vessels. It is attached to Poupart's ligament, and also to the border of the saphenous opening of the fascia lata. The blood-vessels that are contained in the layers of the superficial fascia, are the external pudic, external epigastric, and external circumflex arteries, and small veins; these vessels exert an important influence on the course of femoral hernia, which, after it has passed through the saphenous opening, owing to the resistance afforded by these superficial blood-vessels, bulges forwards, inwards, and upwards.

Fascia superficialis.

After dissecting off the superficial fascia, the boundaries of the inferior or superior crural region are now more accurately defined. The inguinal region is a triangular space, having its base placed anteriorly, its apex inferiorly; it is bounded superiorly by Pou-

Boundaries of the inguinal region.

part's ligament, inferiorly by the approximation of the sartorius and adductor muscles; on the outer side, which is round and very prominent, it is bounded by the sartorius, iliacus rectus, and pectineus muscles, all covered by the fascia lata: and on the inner side, which is somewhat flattened, by the adductors and pectineus, all covered by the fascia lata. Between the fascia lata and fascia *fascia superficialis*, are situated about a dozen inguinal lymphatic glands, mixed with a variable portion of fatty matter, especially in females, together with several small blood-vessels and the saphena

Inguinal glands.

The glands may be divided into a superficial and deep set; the former are more numerous, and are arranged in two rows; the anterior row are four or five in number, and small, lying parallel

with Poupart's ligament, some above, others below it; the inferior are two or three in number, larger, and placed perpendicularly or parallel to the saphena vein; and frequently one is placed posterior to this vessel; the deep inguinal glands, in number about three or four, lay beneath the fascia lata, and are closely connected to the sheath of the femoral vessels, chiefly to its inner side: one or two very constantly occupies the femoral ring.

Adipose tissue.

Having raised the fascia superficialis, it will be observed, that a particular depression, more or less distinct, according to the quantity of fat, is brought into view. This hollow, which requires to be especially noticed, inasmuch as it lodges the tumour of femoral hernia after the protrusion has cleared the saphenous opening, is placed on the inner side of the groin, below Poupart's ligament, and in front of the pectineus muscle. In fat persons, and particularly in females, this depression is filled up with a large quantity of adipose substance.

Fascia lata.

The fascia lata, which is the common investing membrane of the lower extremity, presents externally a smooth glistening appearance, and forms an uninterrupted sheath until it comes within about an inch of Poupart's ligament. In this situation the fascia splits into two portions, which leave between them an opening for the transmission of the superficial vessels. The saphena vein and superficial lymphatic vessels, after continuing their course throughout the whole extent of the lower extremity on the surface of the fascia, at length pass through this opening to communicate with the deep seated vessels. The fascia lata may in general terms be said to be united to the spine of the ilium, to Poupart's ligament throughout its whole length, to the spine of the pubis, and to the linea innominata: it is more convenient, however, to examine each portion separately. The outer or iliac portion, ascending from the external surface of the thigh, is attached superiorly to the spine of the ilium, and to the whole length of Poupart's ligament, and being continued in front of the femoral vessels, where

Iliac portion of the fascia lata.

is closely connected with the sheath, it at length turns rather upwards, and terminates by being inserted into the linea innominata, where it becomes attached to the base of Gimbernat's ligament.

The iliac portion of the fascia lata, being thus attached, then passes downwards, and becomes united underneath the vena saphena major, with the internal or pubic portion of the same structure.

The pubic, or inner portion of the fascia lata, covers the adductor muscles on the inside of the thigh. It is attached internally to the ramus of the ischium and pubis, anteriorly to the ligament of Gimbernat, superiorly into the linea ileo-pectinea. Passing down, it soon divides into two portions, a superficial and deep; the inner continuing to pass downwards, unites under the saphena vein, as before stated, with the iliac portion of the fascia. The deep portion passes behind the femoral blood-vessels and their sheath, as far as the border of the psoas muscle; it there splits into two processes; one passes beneath the psoas tendon, and becomes attached to the capsular ligament of the hip joint; whilst the other, lying more superficially, passes over that tendon and becomes continuous with the fascia iliaca.

Pubic portion of the fascia lata.

Between the iliac and pubic portions of the fascia lata, an opening is usually described as being left, called, from the circumstance of its transmitting the vena saphena major, the *saphenous foramen*. This opening is placed about half an inch below Poirart's ligament, and in front of the femoral vein. It is surrounded by the inner margin of the iliac portion of the fascia lata, which margin has received the name of *falciform process*.

Saphenous opening.

This important structure presents a concavity which looks downwards and inwards. The upper course of this arch extends as far as the crural ring and Gimbernat's ligament; whilst the lower course is lost under the vena saphena, by uniting with the pubic portion of the fascia lata.

Falciform process.

Some difference of opinion exists concerning the exact disposi-

tion of the fascia lata at the saphenous foramen. If the falciform process be raised by the forceps, it will be observed that it does not abruptly terminate; but that it sends a membranous prolongation down to the femoral sheath, with which structure it appears to become continuous. According to some anatomists, however, the iliac portion of the fascia, is actually continued across in front of the femoral sheath, and reaching the inner side of the femoral vein, it is said to become continuous with the pubic portion of the fascia.

Cribriform
fascia.

Whichever of these accounts is correct, it is certain that extending across the saphenous foramen, there is a layer of membrane, much thinner than the fascia lata, and placed between the inner surface of the superficial fascia, and the outer surface of the femoral sheath, from both of which it appears to be distinct. This structure is perforated by the vena saphena major, by the small superficial blood-vessels of the groin, and by many lymphatics, and it is owing to this circumstance that it has received the denomination of *fascia cribriformis*.

Anatomy of the
parts in the pel-
vis.

It is necessary now to proceed to the consideration of those parts which are connected with the abdominal cavity. In order to expose these parts, the anterior wall of the abdomen should be divided, and the viscera situated in the neighbourhood of the iliac fossa removed. The peritoneum lining the abdominal and iliac muscles, is then to be raised, which, in consequence of the laxity of the sub-serous cellular tissue, is easily accomplished without disturbing the connexions of the adjacent parts. This having been accomplished, it will be observed that the fascia transversalis, lining the abdominal walls on the fore part, and the fascia iliaca lining the walls on the back part, became united with each other at the deep or abdominal edge of Poupart's ligament, from the anterior superior spinal process of the ilium, as far as to the outer border of the external iliac artery; but it is found that where the iliac blood-vessels pass under the crural arch to reach the thigh, the two fasciæ are prolonged with them (the fascia transversalis

on the fore part, and the fascia iliaca on the back part) in the form of a tube, which is flattened from before backwards; this tube is the *femoral* or *crural sheath*. It is particularly necessary to remark, that whilst the fascia transversalis on the outer side of the iliac blood-vessels, descends almost vertically into the thigh, and is closely applied to the side of the artery, that on the inner side, turning around the concave edge of Gimbernat's ligament, it is not immediately applied against the inner surface of the iliac vein. In consequence of this disposition, the femoral sheath assumes on its upper and inner side an infundibular form. Femoral sheath.

The sheath thus formed contains on the outer side the femoral artery, in the middle the femoral vein, and on the inner side a few lymphatic vessels; but it is proper to remark, that, in consequence of there being two septa passing from the anterior to the posterior part, each vessel is contained within a special division of the sheath. Contents of crural sheath.

If we endeavour to push the finger from the abdomen underneath Poupart's ligament into the thigh, it will be found that the junction of the two fasciæ prevents this being done on the outer side of the iliac artery; and that, in front of the blood-vessels, although the part is more yielding, yet the two septa just described offer a degree of resistance which is sufficient to prevent any descent of the viscera taking place in that situation. But on making pressure on the inner side of the iliac vein, the finger instantly sinks into a hollow, and, if the pressure be considerable, it passes completely under Poupart's ligament into the thigh. This hollow is the *crural* or *femoral ring*, and as this is the precise point where femoral hernia invariably protrudes, it is desirable carefully to consider its relations. The crural ring is situated in that part of the femoral sheath, which is placed between the external iliac vein and the concave border of Gimbernat's ligament. It is bounded in front by Poupart's ligament, behind by the body of the pubis, on the iliac side by the external iliac vein, and on the pubic side by Gimbernat's ligament, whilst placed closely above Crural ring.

cess, which may be named the *crural canal*, is analogous to the inguinal canal, and the saphenous opening, by which the hernia reaches the surface of the body, resembles the external ring.

Coverings of
crural hernia.

The coverings of femoral hernia are, first, the skin, then the superficial fascia, below that the cribriform fascia, then the femoral sheath, and lastly, a little fatty cellular membrane, which, in old herniæ, becomes very much thickened, and readily separates into several layers, that has by some been called the *fascia propria*.

Seat of struc-
ture.

The seat of stricture in femoral hernia is either the upper part of the femoral sheath, the neck of the sac, or the falciform process of the fascia lata. In dividing the stricture, it is necessary to consider the position of the surrounding vessels. Immediately above the ring is situated, in the male the spermatic cord, in the female the round ligament; to the outer side, the epigastric artery; and sometimes, though very rarely, the obturator artery is situated on the anterior and inner side of the sac; in that case the ring would be almost surrounded by blood-vessels; this, however, is of very rare occurrence. Considering the *usual* relative position of the different vessels to the ring, the safest mode of dividing the stricture is *upwards and a little inwards*.

LECTURE XLI.

ON HERNIA.

Importance of
the subject.

THIS, of all the diseases to which the human body is liable, demands, upon the part of the surgeon, a large share of anatomical knowledge, great promptitude and decision, and the utmost skill and dexterity in the performance of an operation, when it is rendered necessary, by a defeat of the means employed for its reduction. In other important cases, consultations may be held, or the patient be sent to a distance to obtain the advantage of the best opinions; but in hernia the fate of the patient is decided almost upon the instant, and an hour's delay may turn the scale of

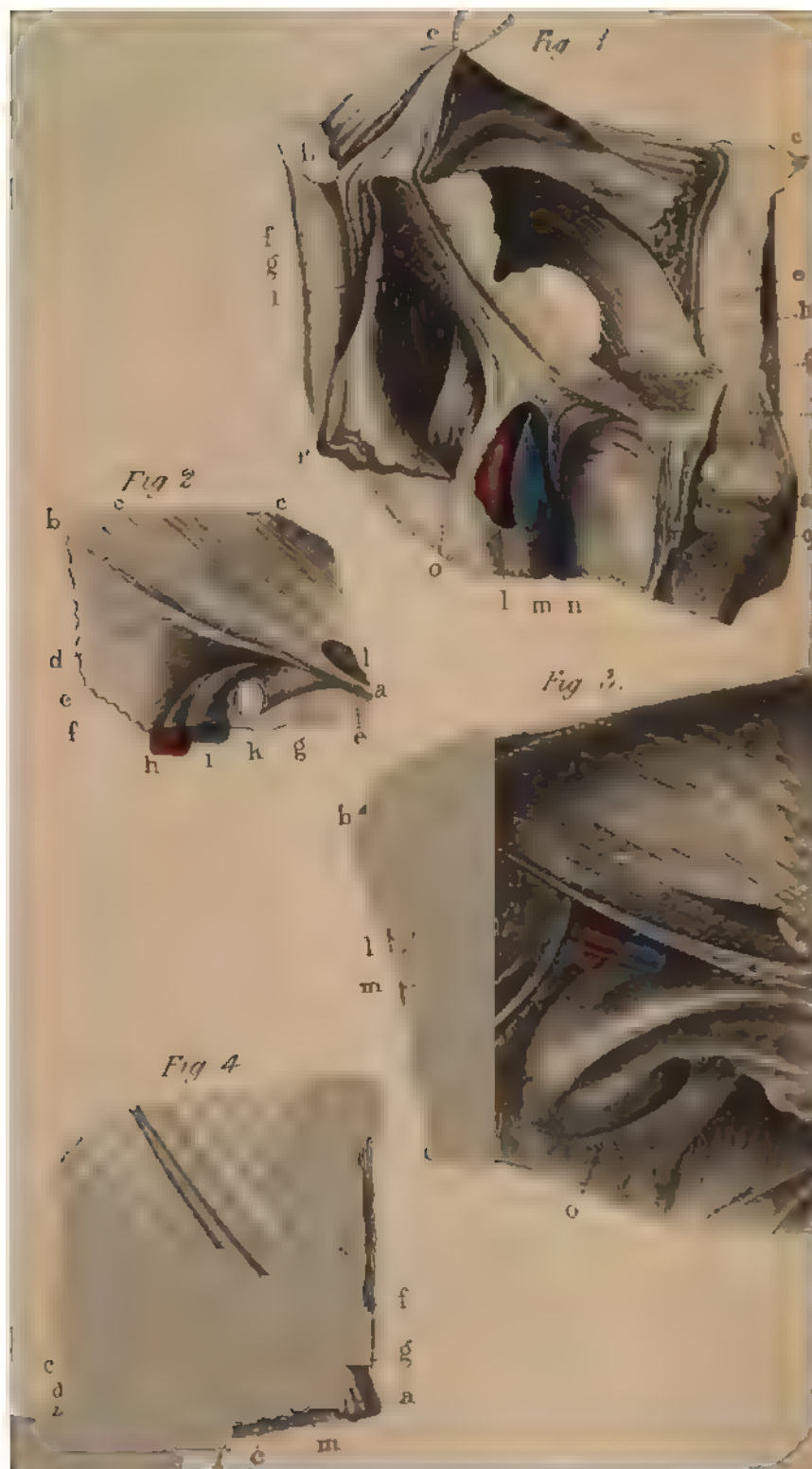


PLATE II.

This Plate contains views of the anatomy of the groin and upper part of the thigh.

Fig. 1. Shews the crural sheath.

a, Pubes.

b, Ilium.

c, Abdominal muscles drawn up.

d, Transversalis muscle.

e, Its tendon.

f, Seat of the posterior edge of the crural arch.

g g, Fascia transversalis.

h, Interior portion of the same fascia.

i, Fascia iliaca.

k, Femoral sheath.

l, Femoral artery.

m, Femoral vein.

n, Saphena major vein.

o, Anterior crural nerve.

p, Fascia lata turned back.

q, The tendon of the external oblique muscle drawn down.

Fig. 2. Crural hernial sac removed to shew the opening by which it descends in the female.

a, Seat of the pubes.

b, Crural arch extending towards the ilium.

c c, Abdominal muscles.

d, Crural arch.

e e, Fascia lata.

f, Semilunar edge of the fascia lata.

g, Third insertion of the external oblique.

h, Femoral artery.

i, Femoral vein.

k, Femoral sheath.

l, Abdominal ring.

m, The orifice by which the crural hernia descends, formed on the outer side by the crural sheath, on the inner by the semilunar insertion of the tendon of the external oblique, and above in part by the crural sheath, and in part by the semilunar edge of the fascia lata. The division in crural hernia is made at the upper and inner part.

PLATE II., CONTINUED.

Fig. 3. Posterior view of the external oblique muscle, of the external iliac artery and vein, and of the fascia iliaca.

- a*, Symphysis pubis.
- b*, Spinous process of the ilium.
- c*, Linea ileo-pectinea of the pubes.
- d*, External oblique muscle and its tendon.
- e*, Superior column of the tendon of the abdominal ring.
- f*, Insertion of the inferior column of the ring into the tubercle of the pubes.
- g*, Third insertion of the external oblique into the ligament of the pubis, from whence it is extended towards the symphysis.
- h*, Abdominal ring.
- i*, The fascia iliaca extending over the iliacus internus and psoas muscles.
- k*, The junction of the fascia iliaca with the posterior edge of the crural arch.
- l*, External iliac artery.
- m*, External iliac vein.
- n*, Posterior edge of the crural arch, extending from the pubes to the ilium.
- o*, Thyroideal foramen.

Fig. 4. Anterior view of the arch, a hernial sac having been removed to shew the orifice by which it descends.

- a*, Symphysis pubis.
- b*, Crural arch.
- c c*, Fascia lata.
- d*, Semilunar edge of the fascia lata.
- e*, Crural sheath.
- f*, Abdominal ring.
- g*, Spermatic cord.
- h*, Femoral artery.
- i*, Femoral vein.
- k*, Anterior column of the crural sheath, which requires division in the operation for crural hernia.
- l*, Lower column of the same opening.
- m*, The opening in the side of the sheath by which the crural hernia descends.

success against the surgeon, and destroy the prospect of safety on the part of the patient.

A hernia is a protrusion of any viscus from its proper cavity; but the term is principally applied to the protrusions of the abdominal viscera, to which it is at present my intention to confine my description. Definition.

The abdomen is particularly liable to such protrusions, on account of the moveable state of its viscera, of the natural openings from it to give passage to blood vessels, and unnatural apertures from deficiency of structure, and from the great changes in bulk to which the omentum and mesentery are subject; so that instead of being surprised at the frequency of its occurrence, it might be expected, from a knowledge of anatomy, that it would occur in many more instances than it does. Abdomen particularly liable to such protrusions.

There are several genera of abdominal herniæ; four of which, however, are more frequent than the others; viz. the inguinal, the femoral, the umbilical, and the ventral; but beside these, there is a hernia through the ischiatic notch, one through the foramen ovale, a pudendal, a perineal, a vaginal, occasionally a protrusion takes place through the diaphragm, the kidneys have been found in a swelling in the loins, and the small intestines have been seen between the laminæ of the mesentery and mesocolon: but, to the two latter, the term hernia is scarcely strictly applicable. Kinds of hernia.

OF INGUINAL HERNIA.

Of this hernia, there are four different species:—

- | | |
|---|----------------------|
| 1. The oblique, taking the course of the spermatic cord. | Of inguinal hernia. |
| 2. The direct, descending from the abdomen immediately through the external abdominal ring. | Oblique.—
Direct. |
| 3. The congenital, or a protrusion into the tunica vaginalis. | Congenital. |
| 4. The encysted hernia, composed of a bag and protrusion suspended in the tunica vaginalis. | Encysted. |

Before any hernia is formed, unless in wounds, laceration, or deficiency of structure, a bag of peritoneum precedes the pro- Contained in a sac.

truded viscera, and forms a sac in which they are contained, and which is usually called the hernial sac. This protrusion is somewhat thicker than the natural peritoneal lining of the abdomen, the pressure of the viscera leading to an interstitial deposition into the membrane; it is not placed loosely in the parts into which it is protruded, but it adheres by cellular tissue to all the surrounding structures.

OF THE OBLIQUE INGUINAL HERNIA.

Synonymes.

This is also called bubonocoele when seated in the inguinal canal; and, when it further descends, is named scrotal; as it takes the course of the spermatic cord, it might well be denominated spermatocele.

Before I describe the course and dissection of this hernia, it is necessary that I should say something on the structure of the inguinal canal, and of the course of the spermatic cord.

Structure of the inguinal canal.

The spermatic cord first quits the abdomen mid-way between the anterior superior spinous process of the ilium and the symphysis pubis; it here passes between two layers of the fascia transversalis, the anterior layer of which is fixed in Poupart's ligament, whilst the posterior layer descends behind Poupart's ligament, and assists in covering the femoral artery and vein, and in forming the crural sheath; above the passage of the spermatic cord, the two planes of this fascia unite, and form a lining to the transversalis muscle, extending as far as the diaphragm. As the cord penetrates between these two planes, which form the internal ring, a thin layer of fascia unites it to the edge of each.

Epigastric artery.

No part of importance is situated between the anterior superior spinous process of the ilium, and the point at which the spermatic cord passes through the fascia transversalis; but between the latter place and the pubes, the epigastric artery takes its course. This artery is situated from one-fourth to one-half an inch upon the inner side of the internal abdominal ring, or passage of the spermatic cord, from the abdomen, and it passes to the inner

part of the rectus muscle. The external iliac artery and vein are directly behind this internal abdominal aperture, and this opening is the beginning of the inguinal canal, in which the spermatic cord is next continued.

The inguinal canal is bounded anteriorly by a superficial fascia, from the abdominal muscles, and by the tendon of the external oblique; posteriorly, by the fascia transversalis, and by the tendon of the transversalis muscle; above, by the edges of the internal oblique and transversalis muscles, and below by Poupart's ligament; the canal is about two inches in length, and terminates at the external abdominal ring.

Boundaries of the inguinal canal.

The external abdominal ring is formed by two columns of the tendon of the external oblique muscle united by fibres from Poupart's ligament; the upper column is inserted into the symphysis pubis, the lower column into the tuberosity of the pubes, the pubes bound the opening below; between these columns the spermatic cord passes; and from the edge of the ring, as well as from the surface of the tendon of the external oblique muscle, a thin fascia descends, uniting the cord to the edges of the opening, and passing down upon it to the tunica vaginalis; this fascia is then situated between the skin and the cremaster muscle; which muscle arises within the inguinal canal from the internal oblique muscle; it descends with the spermatic cord, and passes through the external abdominal ring; spreading over the fore and lateral parts of the cord as far as the tunica vaginalis, into which it is inserted.

External ring.

Behind the fascia and cremaster muscle the spermatic cord is found passing to the testis; it is covered by the tunica vaginalis, and is composed of the spermatic artery and vein, absorbents, and nerves, with the vas deferens and an artery accompanying it.

Spermatic cord.

The oblique inguinal hernia first enters the upper opening of the inguinal canal, or internal abdominal ring, so that at its commencement it is placed just mid-way between the anterior superior spinous process of the ilium and the symphysis pubis, and close above Poupart's ligament; it has the spermatic cord behind it, and the epigastric artery to its inner side: when in the inguinal

Origin and course of the hernia.

canal it is about two inches in length, and is covered anteriorly by the superficial fascia of the external oblique muscle and by the tendon of that muscle, the inferior edges of the internal oblique and transversalis muscles form an arch over it; the cremaster muscle covers it partially; it has a thin slender covering from the edge of the internal ring; the fascia transversalis, strengthened by the tendon of the transversalis, is situated behind it, and to its inner side; and Poupart's ligament is placed below it.

Appears at the external ring.

Having descended through the inguinal canal, it next emerges at the external abdominal ring, and it is then usually denominated scrotal hernia.

Increases more rapidly.

Its increase being then much less restrained than before, it descends on the fore part of the spermatic cord to the testicle, at the upper part of which it usually terminates.

Dissection of the hernia.

Upon dissecting this hernia below the external ring, there is found covering it;—first, the fascia of the spermatic cord, derived from the external oblique tendon and the edge of the abdominal ring; this substance is dense, and forms a strong covering, which has often been mistaken for the hernial sac; when this has been divided, the cremaster muscle becomes exposed, covering the fore and lateral parts of the hernial sac. The cremaster muscle is thicker than the fascia of the cord, and its muscular texture is easily distinguished in the living body. On cutting through this muscle, and a dense cellular tissue, the hernial sac is laid bare, united on the fore part to the cremaster muscle, and on the posterior part to the spermatic cord, resting below upon the tunica vaginalis of the testicle.

Usual contents of the sac.

The usual contents of the hernia are either intestine or omentum; if the former, it is called enterocele; if the latter, it is denominated omental, or epiplocele. In the young, omental hernia is rarely met with, it being generally intestinal, for this obvious reason, that the omentum in the young subject covers only the superior abdominal viscera.

EXPLANATION OF PLATE V.

In this plate a common inguinal hernia is shewn upon the left side, taking its course through the abdominal ring on the outer side of the epigastric artery, between that artery and the spine of the ilium. The hernia upon the right side is that variety of the inguinal hernia which passes from the abdomen on the inner side of the epigastric artery, or between that artery and the symphysis pubis.

- a.* Symphysis pubis.
- b.* Anterior superior spinous process of the ilium.
- c c.* The spine.
- d d.* The acetabula.
- e e.* The tuberosities of the ischia.
- f f.* Abdominal rings.
- g g.* Poupart's ligament.
- h.* Linea alba.
- i.* Aorta.
- j.* Bifurcation of the aorta.
- k k.* Iliac and femoral arteries.
- l.* Origin of the epigastric artery on the right side.
- m m.* Course of the epigastric artery on each side, marked by dotted lines: the left passing on the inner, the right on the outer side of the hernial sac.
- n.* Vena cava inferior.
- o o.* Spermatic arteries.
- p p.* Spermatic veins.
- q q.* Spermatic cords.
- s s.* Testes.
- t.* Oblique hernial sac upon the left side, situated upon the outer side of the epigastric artery.
- v.* Direct hernial sac upon the right side, placed upon the inner side of the epigastric artery.
- w.* The spermatic cords passing on the outer side of the direct hernial sac, whilst it is seen on the posterior part of that on the opposite side.

VARIETIES OF OBLIQUE INGUINAL HERNIA.

- Varies in size.** From the description which I have given of this hernia, it is clear that it may vary in length, from the upper ring to the testicle, and consequently that it is sometimes seen occupying only the inguinal canal.
- Sometimes very large.** In some cases the hernia is so large as nearly to reach the knee, but in general it does not exceed two fingers' breadth, and barely reaches to the upper part of the testicle; its bulk depends considerably upon the time which it has existed, upon the degree of relaxation of the patient, and upon his inattention to the disease.
- Unusual protrusions.** I have seen the pylorus descend to the mouth of the hernial sac. The urinary bladder is also occasionally situated within it; and we have an excellent specimen in the collection at Guy's Hospital, of an inguinal hernia in the female, where the ovarium and Fallopian tube are protruded into the hernial sac.
- Usual situation of the spermatic cord.** The spermatic cord is usually situated behind the hernial sac; but in one of the preparations in the Museum at St. Thomas's Hospital, the cord is divided, the vas deferens passing upon one side, and the spermatic artery and vein upon the opposite side. I have seen also the spermatic artery and vein passing over the fore part of the sac, while the vas deferens passed behind it.

SYMPTOMS OF INGUINAL HERNIA.

- Distinction from other diseases.** It is discriminated from other diseases by the following marks:—it gradually descends from the abdomen in the course of the spermatic cord: it usually protrudes in the erect, and retires when the patient is in the recumbent posture: it dilates upon coughing, and upon all exertions of the abdominal muscles: flatus may be often felt in it when it is intestinal, and it retires with a gurgling noise: when omental it has a doughy feel, is much less elastic than the intestinal hernia, and retires into the abdomen more slowly; the intestinal is accompanied with costiveness, and with pain across

the abdomen ; the omental rarely produces any disturbance of the abdominal functions, when in the reducible state ; the hernia of the bladder is distinguished by the diminution of the swelling during the evacuation of the urine.

The following are the principal marks of distinction from the diseases with which it is most likely to be confounded.

From hydrocele, by that disease beginning below, and gradually ascending, by its transparency, by its fluctuation, its pyriform shape, its involving the testicle, and by the want of dilatation from coughing ; however, there is an exception to this, if the hydrocele enters the upper part of the scrotum, when it sometimes dilates upon coughing, and the only means of distinction are in its history, its transparency, and its fluctuation. From hydrocele.

From hydrocele of the spermatic cord, it is with great difficulty distinguished, unless the hydrocele emerges from the external ring, when its transparency indicates its true nature. From hydrocele of the cord.

Hydrocele and hernia are sometimes combined in the same individual, of which there is a beautiful specimen in the collection at St. Thomas's Hospital ; a case of this kind occurred to Mr. Thomas Blizard, on which he operated, and a similar one to Mr. Henry Cline ; in each case the water was in the first instance discharged, and then the hernial sac became exposed behind the tunica vaginalis. Hernia and hydrocele sometimes combined.

Hydrocele is also connected with hernia, when there is water in the abdomen ; and I have tapped a hernial sac in ascites for the discharge of the accumulated water, and it is the best mode of operating in such a case, when it is quite certain that neither the omentum nor intestine is descended, and that you can decide by the transparency.

Hernia is known from hæmatocele, by the latter being usually the result of a blow, and by the ecchymosis which at first accompanies it, by its not extending to the inguinal canal, by its not dilating upon coughing, by the bowels being undisturbed, and by its not returning into the abdomen. From hæmatocele.

Hernia is little liable to be confounded with disease of the testicle. From diseased testicle.

ticle ; the history of the swelling, its form, the distinctness of spermatic cord, the want of intestinal obstruction, the absence of dilatation on coughing, and its not returning into the abdomen, sufficient marks of the latter disease.

Hernial sac connected to the spermatic cord.

I have seen, however, diseased testicle complicated with hernia, and have twice been under the necessity of dissecting the hernial sac from the spermatic cord, during the extirpation of the diseased testicles. In one case I opened the sac unintentionally in operation, but it did not prevent the patient from doing well.

Acute inflammation of the testicle, mistaken for hernia.

The acute inflammation of the testicle is the only state which I have known confounded with hernia ; the tenderness of the part, the swelling extending up the cord, and the vomiting accompanying the disease, led to a doubt which could only be removed by knowledge of the history and progress of the complaint.

From varicocele.

The disease with which hernia is most frequently confounded is varicocele, or enlargement of the spermatic veins ; this is a very common complaint, it occurs most frequently upon the right side, and is supposed to be founded in the termination of the spermatic vein, at right angles with the emulgent. It sometimes dilates upon coughing ; it appears in the erect, and retires in recumbent position. It is distinguished from hernia by its fluctuation (which resembles that of a bag of large worms,) by its being not attended with intestinal obstructions, by placing the patient in recumbent posture, and emptying the swelling into the abdomen, then pressing the finger upon the external ring to prevent the visceral descent, by which the free return of blood by the spermatic vein is obstructed, and the swelling re-appears when no hernia could escape.

Truss applied for varicocele.

I have more than once known a truss applied for this disease, and in one instance to the son of a medical man, by his father.

This hernia most frequent on the right side.

Inguinal hernia occurs more frequently upon the right side than the left, probably because the greatest exertions are made of the right side, from the preference we give to the use of the right arm ; two thirds of inguinal herniæ are upon the right side.

CAUSES OF HERNIA.

All the causes of hernia usually alleged may be resolved into two kinds : those which diminish the resistance of the abdominal muscles, and those which increase the pressure of the viscera. The cause most generally predisposing to this disease is debility; *Debility.* by occasioning relaxation of fibre, it produces a dilatation of the apertures through which the spermatic vessels pass, and thus affords a passage for the protrusion of the viscera. The same cause also operates in elongating the attachments of the viscera, rendering them thereby more extensively mobile, and, consequently, more liable to be displaced from their natural situation.

If a person debilitated by fever, returns to a habit of violent ex- *After fevers.* ertion before his strength is fully re-established, a swelling of the groin will often occur, which proves to be a hernia. Old age also, from the general relaxation it produces, is so frequently attended with this complaint, that I have been surprised to find but few old *Frequent in old men* entirely exempt from it. Having neglected no opportunity of procuring specimens of this disease, and inspecting the bodies of old people, I have scarcely ever been disappointed in finding either inguinal or femoral hernia. The subjects which I have examined, however, have principally been old persons who have been obliged to labour for their subsistence after their strength became unequal to great exertions.

Those who work hard, and live more on fluid than solid food, are also very subject to hernia; whence its frequency among the poor of this town, who work to the utmost of their strength, and subsist very much upon liquids.

Heat of climate and seasons, warmth of clothing during the day, and warm covering at night, must also be reckoned as predisposing causes of this disease. Herniæ, though frequent in Eng- *More common land,* are much less common here than in the South of Europe or in Africa. A gentleman thus writes from Malta: "This is the place where hernia should be studied; for, from the extreme

relaxing heat of the climate, assisted by the constant exertions which the inhabitants are obliged to make in passing their rocky paths, few persons escape the disease, and it is often of an enormous size."

Frequency of
hernia in Egypt.

In Egypt, too, we have the testimony of medical men who attended the late expedition, that herniæ are extremely common there, and often of an unwieldly bulk. Of this, Sir Robert Wilson mentions the following instance: "I saw a man who had a belly hanging down from his navel to his ancles, a blue skin contained his bowels, but which seemed so thin, as to be liable every moment to burst. The weight was enormous, and the size appeared much larger than an ox's paunch. The unfortunate wretch was otherwise in good health, and crawled about gaining his bread by begging."

From obesity.

There are also causes which diminish the resistance of the muscles and tendons. Thus, a person naturally fat, who has become suddenly lean, is, in consequence, generally the subject of hernia; for the fat which had loaded the spermatic chord, and had extended the apertures to and from the abdomen, being suddenly absorbed, room is left for the viscera to supply its place. In some

From hereditary
conformation.

respect it appears to depend on hereditary conformation of the parts of the groin; for I have frequently been consulted by fathers, themselves wearing trusses, for more than one of their sons afflicted with the same complaint. A gentleman applied to me with his two sons, all labouring under the disease. The father had a right inguinal hernia, the eldest son an umbilical, and the youngest a ventral hernia, between the ensiform cartilage and umbilicus, from a deficiency in the linea alba. Dr. S., his grandfather, and great grandfather, had an inguinal hernia brought on by the same cause—violent efforts while out shooting. In such cases as these, I have found by attentive examination the abdominal ring very imperfectly formed; so that instead of the ring extending an inch in length, it could be traced nearly half way to the ilium. Hence it would seem, that in these persons the tendon which strengthens the superior angle of the ring, either does not

exist at all, or is at least very imperfect ; for, whoever is in the frequent habit of dissecting the abdominal ring will find it varying both in extent and in the firmness with which it is closed, being in some subjects carefully shut by the transverse tendon from the ilium, while in others, this tendon is very small or even entirely wanting. In such persons the slightest cause is sufficient to produce hernia.

Hernia is often suddenly produced by blows. A gentleman consulted me concerning a tumour which had appeared in his groin after he had been thrown from his horse in hunting. He fell upon the post of a gate, which struck against his groin, and he immediately felt great pain, and found a swelling in the part, which proved to be a hernia. A young gentleman from America, who had a hernia, told me that it appeared immediately after having received a kick from his schoolmaster. Neither of these, however, was oblique inguinal hernia, but a variety that will be hereafter described, produced, I believe, by a laceration of the tendon of the internal oblique and transversalis muscles.

Hernia produced
by blows.

Violent actions of the abdominal muscles, by the pressure which they exert upon the viscera, become frequent causes of hernia. It is in this way that coughing produces this disease. Children have occasionally been brought to me with this disease during hooping-cough. Few persons who have been long afflicted with asthma are free from it, and those who play upon wind instruments are more subject to it than others.

From coughing.

But of all the causes of hernia, the most frequent is the lifting of heavy weights, an action which strongly exerts the abdominal muscles at the time the body is bent. In this position the lower part of the abdomen is not contracted to the same degree as the upper, the viscera are forced downwards by inspiration, and compressed by the abdominal muscles above, whilst the openings of the groin are relaxed by the posture of the body.

From lifting
heavy weights.

I am informed that few persons are more subject to hernia than the men who work in our dockyards : the great weights which they

are in the habit of lifting, and the stooping position in which they often work, will, I think, sufficiently account for this circumstance.

From habitual
costiveness.

Persons who suffer under habitual costiveness, are not only subject to hernia, but have the symptoms of strangulation often brought on whilst at stool, owing to the strong pressure made on the abdominal muscles during the difficult expulsion of *fæces*. Hence it is right to caution persons subject to hernia to avoid every cause of constipation.

From urethral
stricture.

Strictures in the urethra appear to be a very frequent cause of this disease, as the difficulty in passing urine must necessarily call for more powerful action of the abdominal muscles. In the body of a man who had a stone in the urethra, which I opened with Mr. Weston, surgeon in Shoreditch, we found several hernial sacs. A man was lately in the accident ward of Guy's Hospital, who had an inguinal hernia appear soon after he began to labour under dis-
eury from enlarged prostate gland.

From the viscera
becoming too
large.

There are causes of this disease that principally affect the viscera, and in which the abdominal muscles may be said to be nearly passive. Thus the viscera become too large for the cavity of the belly in an extreme degree of obesity, which loads the omentum and mesentery with fat, and they are compelled to protrude through any opening that presents itself. If the fatness comes on very rapidly, it seldom fails to produce this disease, as the abdominal muscles cannot immediately accommodate themselves to the enlargement of the belly.

From external
pressure.

The same effect is produced by constant external pressure, which tends to diminish the cavity of the abdomen, the size of its contents remaining the same. It is thus that hernia is brought on by wearing the breeches very tight about the waist, which pinch up the belly, and do not leave sufficient room for the variations that occur in the size of the viscera after taking food, or from exertions of different kinds. Mechanics who are in the habit of using the implements of their trade against their abdomen, bring on the complaint by pressing the viscera to the inguinal regions.

Plate III

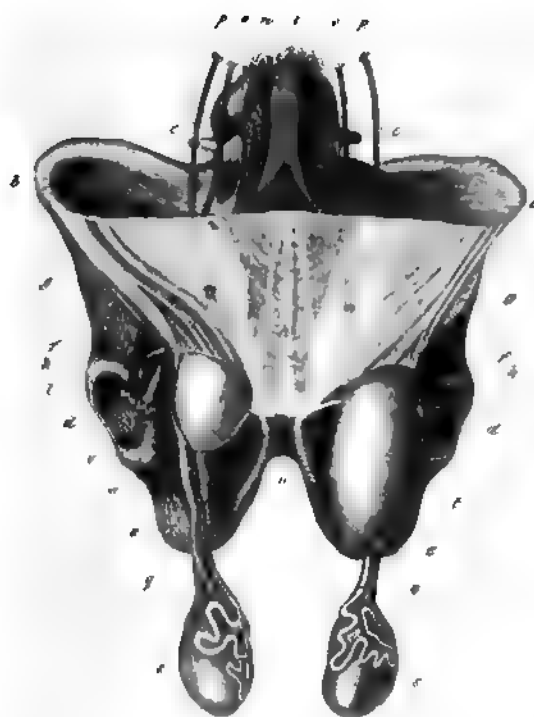


Fig. 3.

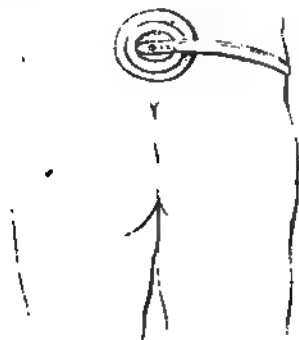


Fig. 5.

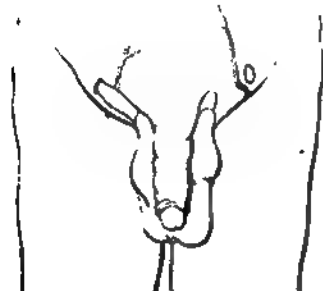


Fig. 1.



Fig. 2.

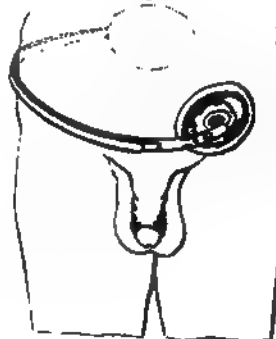


Fig. 4.

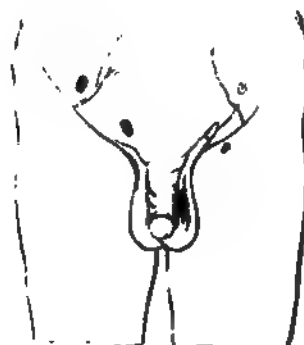


PLATE III.

Shews trusses of different constructions for the support of inguinal and femoral hernia.

Fig. 1. Salmon and Ody's self-adjusting truss. The right pad moves by means of a ball and socket, and is applied to the hernia; the hip pad is of a more rounded form, and is intended for the sacrum. They are connected by a strong steel spring.

Fig. 2. Is an anterior view of the same truss applied to a left inguinal hernia. The spring embraces the opposite side to that on which the hernia is seated, and crosses the pubes to fix the pad upon the rupture; it is hence called the opposite-sided truss.

Fig. 3. Posterior view of the same truss: the mode of applying the pad to the lower part of the spine is shewn. In this truss no circular or thigh strap is required.

Fig. 4. Represents the two apertures through which an oblique hernia descends, and the situation of the epigastric artery; below Poupart's ligament, on the left side, is pointed out the part on which a truss should be applied for a femoral hernia.

Fig. 5. Oblique hernia passing through the inguinal canal upon the right side, and appearing through the external ring as a scrotal hernia. On the left side is seen a direct inguinal hernia which passes on the inner or pubic side of the epigastric artery, and protrudes only at the external ring. The oblique course of that on the right side, shews the necessity of wearing a truss that makes pressure on the inguinal canal, especially in the incipient state of a hernia.

Fig. 6. In this figure a common inguinal hernia is shewn upon the left side, taking its course through the abdominal ring

PLATE III., CONTINUED.

on the outer side of the epigastric artery, between that artery and the spine of the ilium. The hernia upon the right side is that variety of inguinal hernia, which passes from the abdomen on the inner side of the epigastric artery, or between that artery and the symphysis pubis.

a, Symphysis pubis.

b, Anterior superior spinous process of the ilium.

c c, The spine.

d d, The acetabula.

e e, Tuberosities of the ischia.

f f, Abdominal rings.

g g, Poupart's ligament.

h, Linea alba.

i, Aorta.

j, Bifurcation of the aorta.

k k, Iliac and femoral arteries.

l, Origin of the epigastric artery on the right side.

m m, Course of the epigastric artery on each side marked by dotted lines, the left side passing on the inner, the right on the outer side of the hernial sac.

n, Vena cava inferior.

o o, Spermatic arteries.

p p, Spermatic veins.

q q, Spermatic cord.

s s, Testes.

t, Oblique hernial sac upon the left side, situated on the outer side of the epigastric artery.

u, Direct hernial sac upon the right side, placed upon the inner side of the epigastric artery.

w, The spermatic cord passing on the outer side of the direct hernial sac, whilst it is seen on the posterior part of that on the opposite side.

The enlargement of the uterus in pregnancy sometimes occasions hernia, but less frequently the inguinal than the other species. Distention of the stomach operates in a similar way. A frequent and forcible pressure or shaking of the viscera downwards, as happens in riding in rough carriages, is a common cause of this complaint. In the town of Yarmouth, where I formerly lived, I knew many persons who had this disease brought on by riding in the small carts peculiar to that town, and which, from being constructed without springs, were rough and uneasy, and shook the rider in a very severe manner. Coachmen who are much upon, and persons who ride rough going horses, are for the same reason liable to this complaint. The cavalry are much more subject to it than the infantry; and I have known children in whom it has been produced by frequent riding in company with older persons, and constantly going a pace uneasy to them.

Jumping operates in the same way, often suddenly. I have known many persons, after much of this exercise, complain of a pain in the groin, which was soon followed by hernia. In these and every other cause of the complaint, an upright posture of the body strongly contributes to its formation, by keeping up the pressure of the viscera on the lower part of the abdomen.

LECTURE XLII.

OF THE REDUCIBLE INGUINAL HERNIA, AND USE OF TRUSSES.

HERNIAE are found in the three following conditions, reducible, irreducible, and strangulated.

The reducible is that state in which the protruded parts may be returned into the cavity of the abdomen; and as it is attended with no immediate danger to the patient, frequently induces in his mind a false idea of security. A person under these circumstances lives in continual danger, as numerous accidental causes may produce strangulation of the prolapsed intestine, the conse-

Reducible inguinal hernia.

quence of which will be fatal unless early and well directed skill be employed.

To prevent this accident a constant pressure should be applied at the part where the hernia opens into the abdomen, to close the mouth of the sac, and thus oppose an effectual resistance to the protrusion of its contents.

Trusses.

For this purpose, bandages of different kinds and elastic trusses have been invented; but, generally, the instrument that can be most safely relied on, is a truss of steel; other bandages often afford only a false security, more dangerous even than a total omission of this kind of support, since they encourage the patient to take violent exercise without apprehension of the probable consequences. An elastic steel truss, if properly made and well applied, ensures the security of the patient during any degree of moderate exercise, and is no hinderance to any of the common occupations of life.

The pad of a steel truss is composed of a supporting piece of iron, and stuffed so as to take a form on the one hand not too conical, and on the other not too flat. The former occasions pain by an unnecessary degree of pressure, while the latter does not effect the purpose of preventing protrusion. The pad is rivetted on a long flat piece of steel tempered to a great degree of elasticity, and curved to the shape of the lower part of the body, which it embraces like a belt. The length of this steel should be sufficient to pass from the hernia round the region of the groin to about an inch beyond the spine behind, forming somewhat more than a semicircle, but compressed. Both the pad and truss are quilted with leather. A strap of leather proceeds from the hinder end of the truss, which passes round the opposite side of the body, completing the circular belt by fastening upon the pad.

An understrap is sometimes added, which passes down from the back part of the truss between the patient's thighs, and is brought up to the fore part of the pad, to which it is fastened by a stud; this prevents the truss slipping upwards. However, if the pelvis is well formed, that is, standing outwards, or the abdomen is large,

this understrap is not necessary; but when the pelvis inclines towards the abdomen, the truss will slip from its proper position unless retained by the strap.

Many surgeons, and almost every surgeons' instrument maker, have thought proper to vary the form of the truss, and to prescribe different rules for the direction and force of the pressure; but almost all were formerly agreed in determining that the pressure should be made on the external abdominal ring.

This is precisely the circumstance, however, in which they were all defective, and, indeed, it is the frequent failure of the purpose for which they are designed that has led to such variety in the mode of their construction. Defect of old trusses.

The object in applying a truss, is to close the mouth of the hernial sac, and destroy its communication with the abdomen, and this object can never be perfectly fulfilled by any truss which is applied on the external abdominal ring, and extending from it upon the os pubis. Object of applying a truss.

In this case, the cure must be incomplete, because a considerable portion of the hernial sac remains uncompressed towards the abdomen, which portion is that situated between the abdominal ring and the opening into the cavity of the abdomen. Nor is this all the mischief that attends this practice, for the pressure of the spermatic cord by the truss against the os pubis, frequently occasions great pain, to relieve which the patient is constantly shifting its situation and destroying its effect, and often the testes themselves become wasted by the interruption of the blood along the spermatic vessels.

The proper method of obliterating the mouth of the hernial sac is to apply the truss not only on the external abdominal ring, but also on the aperture at which the spermatic cord, and with it the hernia, first quit the abdomen; for the descent of a hernia cannot be entirely prevented, or a cure be effected, but by making pressure on the internal abdominal aperture and on the inguinal canal. Obliteration of the mouth of the sac.

The effect of wearing a truss on this part, is to approximate the sides of the mouth of the sac, and thus to prevent any future de-

Effect of wearing a truss.

scent into the same cavity. If the pressure be long continued, adhesion takes place at the origin of the sac, and interrupts the communication between the abdomen and the cavity of the sac, which being no longer distended by the descent of any viscus contracts in dimensions, and at length becomes entirely obliterated.

When a hernia has been returned by the surgeon into the abdomen, he should lay his fingers obliquely above, and to the iliac side of the ring, and direct his patient to cough, and the furthest part from the ring towards the spine of the ilium where the hernial sac is felt to protrude, is the point which should be noted for the application of the pad of the truss, and the instrument made accordingly.

Manner of measuring for a truss.

Measurement is taken for making the truss by laying one end of a piece of string upon the spot, and carrying the other round the pelvis, midway between the trochanter major and the spine of the ilium, till it meets the fixed point at first determined, and completes the circle. This will be the proper length for the truss. In the above manner I have been in the habit of measuring persons for trusses, excepting when the hips projected unusually, then it is advisable to substitute for the string a piece of iron wire, which, by retaining the precise outline of the patient's hip, serves as a necessary direction for the instrument maker to copy.

Position of the pad.

It will be found that the pad of the truss must be applied proportionally nearer to the abdominal ring in large than in small hernia. When the protrusion is small, the pad may be fixed midway between the symphysis pubis and the spine of the ilium; but as the dimensions of the hernia increase, the mouth of the sac moves gradually nearer the abdominal ring, and the artificial pressure must, in some degree, be regulated accordingly; always remembering, however, that the truss should never be brought on the pelvis, as the pressure on the outer and upper part of the ring will still be sufficient to keep the viscera within the abdomen.

Double trusses.

It happens frequently that hernia appears on both sides of the body. When this takes place, a double truss, or one with two pads and springs must be worn, made of materials similar to the

single truss. To make them sit easy and fit properly, they should buckle behind, and be made longer or shorter at pleasure. This is done by constructing them in such a manner, that one spring will readily slide upon another. The principle of application, and the degree of pressure required, are to be regulated as the single trusses.

As it is an object of importance to the patient to use the bath whilst he is wearing a truss, I have directed the spring to be covered with oil-skin, for the patient should on no account remove it while he is making so considerable an exertion as that of swimming. A truss when first applied, produces some uncomfortable feelings for about a week, after which they wear off, unless the pressure is unnecessarily great, in which case the spring must be weakened, as it frequently brings on inflammation of the testicle. On the contrary, if the hernia ever come down whilst the truss is properly applied, a stronger spring must be provided. The best made truss will chafe at first, however well put, but this inconvenience of a few days may be lessened by interposing a piece of linen between the pad and the skin which generally puts a stop to the uneasy chafing.

It is usual for the patient to enquire how long his truss must be worn. This is difficult to be determined. I have known a hernia to be completely cured by wearing a truss only nine months, and instances are not at all uncommon, of the truss being left off at the end of the year without any relapse of the complaint. But I would at all events advise it to be worn at least two years, even by young persons, in whom alone this complaint is curable by this method.

How long a truss ought to be worn.

As to elderly persons, they must continue to wear it for the remainder of life, for in them there is no probability of such change taking place in the mouth of the sac.

I have never known them long omit its use without experiencing some relapse ; during growth, parts will readily accommodate themselves to pressure, extending or diminishing according to circumstances ; but in adults and in the old this process is much more

tardy. The truss should be worn even during the night, lest any unexpected occasion should call the patient from bed unprepared for the sudden change of posture; for if the hernia once descend during the wearing of the truss, the cure must be considered recommencing from that moment. A patient should be provided with two trusses, in order to guard against the effects of accidents which may render one useless, and he will also experience great comfort in changing his night truss before he rises in the morning. A hernia will remain apparently cured for a considerable time, and return on some sudden exertion. This arises from the adhesions of the orifices of the sac being imperfect, and yielding to the pressure of the viscera. A gentleman, aged twenty-five, applied to me with a return of a left inguinal hernia, which had originally appeared at the age of seven years. He had worn a truss for it till within two years of its second descent, a period of sixteen years, and during the last two years had remained free from any descent of his rupture.

A hernia that thus re-appears is much more liable to strangulation than a recent hernia, on account of the thickening produced in the neck of the sac by the pressure of the truss, which also renders the replacement of the protruded intestine a work of greater difficulty.

There is one circumstance which will always render a prudent surgeon guarded in promising a complete cure of hernia from wearing a truss: it is, that although the original sac may be completely shut at its mouth by adhesion, or perfect contraction, it is possible that another sac may be formed contiguous to the first. In such a case two hernial sacs were found side by side, one open and capable of receiving the bowels when protruded, the other contracted to the size of a goose's quill. In the latter, therefore, the disease was cured, but remained in the former.

Application of
truss to infants.

Steel trusses are equally applicable to infants as to the adult; indeed, less unequal pressure is made by them than by the common inelastic bandages applied round the pelvis. The scrotum of

an infant should be carefully examined to ascertain whether the testicle has descended through the external ring, as the non-descent of the testicle forbids the application of a truss; the sac in such cases is formed by the elongation of the tunica vaginalis, and any pressure made upon it will necessarily prevent the descent of the testicle into the scrotum. The application of a truss should therefore be deferred until the testis has fairly descended below the external ring. The nature of this hernia will be described under the subject of hernia congenita.

When a hernia has been cured by adhesion, as the peritoneum which forms the sac is a secreting membrane, an accumulation of water sometimes collects in it, for a species of hydrocele. The treatment of this disease should be similar to that of hydrocele from other causes.

During the application of a truss it is proper that every part of the protruded contents should be carefully returned, so that no compression be made on them; and if the patient should find that any part has again descended, he should place himself in a recumbent posture, take off the truss, push back the hernia with his hand, and again apply the truss. A person obliged to use a truss, who allows of the descent of a portion of the hernia whilst this instrument is worn, is in greater danger of strangulation of the part than if he wore no truss at all. For when unprotected by this bandage he always feels his danger, and is ready to guard against it; but a bad truss gives the idea of security without ensuring its reality.

When it is clearly ascertained that adhesion of the neck of the sac is effected, the use of the truss may be discontinued; but as this will generally be a matter of uncertainty, great caution must be used before the truss is laid aside. At first the patient may discontinue it at night, taking care to replace it before he rises from bed; he may afterwards remove it, when he is not called upon to make any violent exertion; but before it is wholly laid aside the surgeon should make a particular examination of the abdominal rings, to ascertain if, on coughing or other sudden action of the ab-

Cautions necessary in discontinuing a truss.

dominal muscles, any descent or tendency to protrusion exist at the internal ring.

EXPLANATION OF PLATE VI.

Shews trusses of different constructions for the support of inguinal and femoral hernia.

Fig. 1. Salmon and Ody's self-adjusting truss. The right pad moves by means of a ball and socket, and is applied to the hernia; the hip pad is of a more rounded form, and is intended for the sacrum. They are connected by a strong steel spring.

Fig. 2. Is an anterior view of the same truss applied to a left inguinal hernia. The spring embraces the opposite side to that on which the hernia is seated, and crosses the pubes to fix the pad upon the rupture; it is hence called the opposite-sided truss.

Fig. 3. Posterior view of the same truss: the mode of applying the pad to the lower part of the spine is shewn. In this truss no circular or thigh strap is required.

Fig. 4. Represents the two apertures through which an oblique hernia descends, and the situation of the epigastric artery; below Poupart's ligament, on the left side, is pointed out the part on which a truss should be applied for a femoral hernia.

Fig. 5. Oblique hernia passing through the inguinal canal upon the right side, and appearing through the external ring as a scrotal hernia. On the left side is seen a direct inguinal hernia which passes on the inner or pubic side of the epigastric artery, and protrudes only at the external ring. The oblique course of that on the right side, shews the necessity of wearing a truss that makes pressure on the inguinal canal, especially in the incipient state of a hernia.

6. Common inguinal hernia truss. Its spring encircles half the body, the circle being completed by a strap which is fastened to one of the studs on the long pad. This truss is well calculated for the working classes ; and may be rendered still more secure by a thigh strap to prevent the pad rising, as is seen in Fig. 10.
7. Double truss of the same construction.
8. Represents a posterior view of the common truss, Fig. 8, as worn for an inguinal hernia.
9. Anterior view of the same truss, applied to an inguinal rupture. When required for femoral hernia, the common truss is made with a somewhat larger pad, and the extremity curved downwards so as to reach below Poupart's ligament.
10. Anterior view of the common truss, applied to a double inguinal hernia. Egg's truss differs from the common truss in having a nearly circular spring, and is well calculated to keep up large ruptures which are capable of bearing strong pressure.
11. Represents Coles's single truss for inguinal hernia on the right side.
12. Represents a double truss of Coles's, constructed on the same principle, for inguinal hernia on each side.
13. Represents Coles's half truss for umbilical hernia.
14. Is a representation of the spiral springs forming the pads, and covered with proper materials.

These three last described trusses are capable of every modification, and are certainly the best calculated to prevent the descent of a hernia under any circumstance whatever. The spring is formed with a view to combine the greatest degree of elastic power in the smallest space, and the spiral springs entering into the construction of the pads, gives them a decided superiority over every other truss yet offered to the public. ED.

ON IRREDUCIBLE HERNIA.

When a hernia is incapable of being returned into the abdomen by outward pressure, it is termed irreducible.

The following are the causes which induce this condition of the protruded parts :—

Causes.

First,—When they are suffered to remain long down, they increase so much in size as to be incapable of reduction.

Secondly,—Membranous bands form across the sac, and thus entangling its contents, prevent their free motion.

Thirdly,—The protruded parts become closely united by an adhesion to the sides of the sac, sufficiently firm to render them immoveable.

Danger of irreducible hernia.

By whatever cause a hernia becomes irreducible, the patient is rendered subject to many inconveniencies and dangers. The principal danger is of strangulation of the protruded parts; however this is certainly less in the irreducible hernia than in one that descends only occasionally; for in the former, the sac is already nearly full, and cannot readily admit of any great increase of its contents. But the patient is liable to danger from other causes, as will readily be seen by the following case.

Case.

A man was brought into Saint Thomas's Hospital who had fallen from a ladder, and his scrotum, in which was a large hernia, struck upon the edge of a piece of wood. After complaining of violent pain and tension in his abdomen, in four hours he died. On examining his body after death, a portion of the ilium which had formed a part of the hernia, was found ruptured.

Ulceration.

Another danger incurred by irreducible hernia is that of ulceration. This may happen when any pointed body is swallowed, and follows the course of the food down the intestinal canal into the hernial sac; when arrived in this place, it has been known to make its way out by ulceration, leaving a passage for the fæces.

An irreducible hernia sometimes becomes of a most enormous size when it has remained entirely unconfined, and it then produces

various other inconveniences, of which the case of Mr. Gibbon, the celebrated historian, furnishes a striking example, who had a tumour of such magnitude, as required to be concealed by a peculiar dress. And the penis was deeply sunken into it, so that the urine could only escape by trickling over the surface of the scrotum, which kept it constantly excoriated. Consequences such as these result from a neglect of proper bandages in hernia.

Besides these inconveniences a very large hernia produces a disease of the scrotum itself; an abscess is formed, which is kept fistulous by the constant distension of parts, and can hardly ever be healed without confining the patient to his bed.

When the contents of hernia have become so large and encumbered with fat as to render the disease at that time irreducible, it has been recommended previous to any attempt at reduction to make the patient undergo a course of extraordinary fasting, accompanied with cathartic medicines, and every means to be employed to keep up a copious perspiration. It is scarcely to be doubted, that such a plan would, after a considerable time, be attended with ultimate success; but I have never met with any one who would submit to such a severe regimen to free himself from a disease which only gives a present inconvenience, and does not alarm the patient for the future event.

A more easy and equally effectual method is, to apply a bag-truss to support the scrotum, to lace in front. In this way a considerable pressure is steadily kept upon the parts, which effects a gradual absorption of the adipose matter of the protruded hernia: and thus, after some days' confinement, the tumour becomes very much diminished, and at last may be returned.

Application of
a bag truss.

Hernia sometimes becomes irreducible, as I have before stated, from the formation of membranous bands across the sac, which entangle the protruded parts.

They appear to be produced in the following manner: during the reducible state of the hernia, inflammation takes place, both in the contained parts, and in the inner surface of the sac; but by using proper means, the protruded parts are reduced, and the sides of the

sac collapse and adhere together. However, while the adhesions are still recent, a fresh descent takes place from the abdomen, and the hernial contents again disunite the surfaces of the sac everywhere except at the points of union of these inflamed parts, the cementing lymph of which, instead of bursting asunder elongates with the fresh pressure, and forms those membranous bands which are seen passing from one side of the sac to the other. Between them the intestine and omentum get entangled, a circumstance which adds so much to the difficulty of reduction, as to make it, in general, considered as impracticable; but unless the hernial contents themselves adhere, there appears no reason why the means already pointed out may not here also prove successful. After all there is scarcely a possibility of detecting by the feel this variety of the disease in the living subject.

Irreducible from
hour-glass con-
traction.

They also become irreducible, though rarely, from a contraction in the sac, which I have seen take place in its middle, so as to produce an hour-glass appearance, and a portion of omentum has been confined below and above the contracted part.

Irreducible from
adhesion.

Herniæ are irreducible from adhesion having taken place between the contents of the tumour and the sides of the sac; they are sometimes universal, but more commonly partial; they exist most frequently at the lower part of the sac, but sometimes at its mouth only, and must remain unreturned for the rest of life, unless it be expedient or necessary to undertake an operation. The cases in which such an operation may be proper and necessary will be mentioned in a future place.

Treatment of
irreducible
hernia.

All that can be done in an irreducible intestinal rupture is, to apply a bag truss of the size of the tumour, which, by affording constant pressure, will check the increase of the disease. But if the hernia be omental only, its increase and the subsequent descent of the intestine may be safely prevented by a spring truss. There is so much difficulty, however, in these instances, in the living subject, in determining the precise nature of the hernia, and in deciding whether or not some small convolution of intestine may be descended, that the spring truss should only be fixed after the

most careful examination, the spring itself weak, and it should be entirely thrown aside if it produces any pain or interrupts the functions of the bowels.

In an old irreducible hernia the omentum often becomes diseased. I have seen it affected with schirrus, that is not the schirrus which terminates in cancer, but forming a large and very firm tumour. A specimen of this form of the disease is preserved in the Museum of Saint Thomas's Hospital. Hydatids have been known to be produced in it, but I have never seen an instance of it.

Diseased omentum.

When suppuration occurs, it produces an external abscess. An instance of this happened in a woman who had an abscess in the omentum which had arisen from an old irreducible omental hernia.

STRANGULATED HERNIA.

This form of the disease consists, not only of an irreducible state of the intestine or omentum, but of such a compression of the blood-vessels as to excite inflammation, and totally to interrupt the passage of the fæces through the strangulated portion. The symptoms are, considerable pain in the tumour, and a sensation as if a cord were tied tight around the upper part of the abdomen, or sometimes only around the navel. To these succeed frequent eructations and vomiting, and presently, as an antiperistaltic motion is established through the intestine, bilious matter is brought up. Indeed, when the strangulation has taken place in the colon, I have seen fæculent matter discharged by vomiting, a circumstance which is accounted for, when it is considered that the valve at the end of the ilium is often imperfect, and especially that an antiperistaltic motion will reverse the operation of this valve as well as of the rest of the intestinal canal. I have seen this symptom so often, that I can entertain no doubt on the subject.

Symptoms.

An obstinate constipation attends the vomiting, so that no stools First stage.

can be obtained, except from the portion of intestine below the strangulation by means of glysters. The pulse is quick, and at the beginning of the complaint, hard. If effectual relief be not obtained, the tumour becomes red and painful, and when handled, the mark of each finger is left in a white hollow impression, as occurs on pressure of a dropsical limb. This indicates an effusion of fluid into the cellular membrane covering the hernial sac, produced by the continuance of the inflammation. The abdomen now becomes slightly tense and sore upon pressure, the vomiting very frequent, and the whole body is bedewed with sweat. The constipation remains obstinate, and instead of eructation, hiccough comes on, whilst the countenance shews great anxiety, and the pulse now becomes extremely small and thready, so as to lead those unaccustomed to the disease, to think the patient dying. These symptoms, however, are subject to exacerbations: they are for a time very violent, and described by the patient as spasmodic, after which the patient becomes comparatively easy, so that the surgeon is flattered with hopes that the means he has employed have been successful, till the symptoms again return with more than their former severity.

Second stage.

After having suffered acute pain throughout the first stage of the complaint, the patient becomes suddenly easy, and expresses great satisfaction at this change. The tumour, which still continues, generally assumes a purple or leaden colour, and gives a crackling feel owing to air being contained within the cellular membrane. The abdomen becomes more tense, the hiccough more violent, a cold sweat covers the body, and the pulse, though now fuller and softer than before, if attended to for a little time, is found to be intermittent; but still the patient remains perfectly sensible, and generally continues full of hopes till death, which now speedily puts an end to the complaint. So remarkably strong is this delusive feeling of amendment, that I have known a patient at this extremity insist upon rising and expire in the very act: and another who sat up in bed, called for something to drink, and died as he was putting it to his lips.

If the tumour be examined after death, a quantity of clear serum will first be found under the skin.

The hernial sac contains a quantity of bloody serum of coffee colour, the intestine is of a chocolate brown, with here and there a dark spot, which easily breaks down on being touched with the finger. A coat of coagulated lymph of the same colour of the intestine may be peeled from its surface, and adhesions of no great length are to be found extending from the intestine to the sac. At the particular part where the intestine is strangulated by the constricting membrane, it is either ulcerated through, or readily ruptures under slight pressure. If the inflammation have been very extensive, there is a quantity of air in the surrounding cellulose-membrane.

Post mortem appearances.

The inflammation which takes place in strangulated hernia is different from almost every other species. In most cases it is induced by an unusual quantity of blood sent by the arteries of the part, which become enlarged, but still the blood returns freely to the heart, and the colour of the inflamed part is that of arterial blood: whilst in hernia, the inflammation is caused by a stoppage put to the return of the blood through the veins, which produces a great accumulation of this fluid, and a change of its colour from the arterial to the venous hue. This venous appearance which the intestine assumes ought to be distinctly understood, that it may not be mistaken for mortification, which shews itself either in the appearance of discoloured spots dispersed over the bowel, or in a more complete disorganization of texture, arising from entire loss of vitality, and a consequent putrefactive process.

Inflammation peculiar to hernia.

In dissection, three or four convolutions of intestine are found lying across the abdomen, so enormously distended as to exclude all other viscera from view, and agglutinated slightly together by the effusion of adhesive matter; the track of adhesion is marked by dark lines formed of the inflamed vessels which furnish the secretion. These distended convolutions consist of the portion of intestine immediately above the seat of stricture, and owe their state of extreme distension in part to a collection of fæculent

Post mortem abdominal appearances.

matter, but chiefly to flatus in the cavity of the intestine. The portion of intestine below the structure is, on the contrary, remarkably contracted in diameter, and free from every appearance of inflammation.

**Strangulated
omental hernia.**

In strangulated omental hernia, the symptoms are much less violent than in the intestinal species. The vomiting is not so frequent, the pain in the tumour inconsiderable, the tension not so great over the abdomen, and the constipation by no means so complete; for stools can, in general, be procured during the whole duration of the disease, both by glysters and by cathartics, until the peritoneal covering of the intestines participates in the inflammation. The hiccoughs are violent and constant from the dragging effect on the stomach, and the pulse, though small and frequent, is not so remarkably small and thready as in the intestinal hernia. In this species inflammation occasionally takes place on the skin, though more rarely than in intestinal hernia; and when an extensive slough is thrown off, it is attended with much less constitutional irritation.

**Post mortem
appearances.**

On examination after death from strangulated omental hernia, the omentum is found scarcely changed from its natural appearance, its colour is a little, and but a little, darker than usual. I have found it in some cases, even during the operation, extremely offensive to the smell. There is scarcely any fluid in the sac; though the cavity of the abdomen is inflamed, and the intestines slightly adhering to each other, they never appear to have suffered so much as from intestinal hernia.

Seat of stricture.

On examining the seat of the strangulation in inguinal hernia, it will sometimes be found at the abdominal ring, which from its unyielding nature has operated like a tight cord upon the protruded omentum or intestine, when more of these abdominal viscera have passed down than the aperture would readily admit or allow to return. This is the principal point of strangulation in old and large hernia; but it is more commonly seated at the internal ring, at the place where the spermatic cord first quits the abdomen. The strangulating pressure is here made by the internal oblique

and transversalis muscle and its tendon, which pass over the hernial sac in a semicircular direction, and by the fascia transversalis arising from Poupart's ligament, the semicircular border of which passes under the sac, and which has been mentioned in the anatomical description of the parts, is represented a preparation of a hernia thus strangulated by pressure above the ring. Hereby may be explained the opinion which some surgeons have entertained of the spasmodic nature of the stricture, a state which it was difficult to account for when the seat of strangulation was supposed to be confined to the external ring, as this tendinous aperture possesses no muscular action, and therefore cannot assume the state of spasm. But when the strangulation is at the upper ring, a portion of intestine protrudes under the edge of the internal oblique and transversalis muscles, compressing them, which in their turn, being excited to contraction by the irritation of this pressure, re-act upon the intestine with a force sufficient to produce a strangulation, accompanied with spasmodic symptoms. If then the surgeon, during the operation for hernia, examine accurately into the seat of the strangulation, he will find that, except in large herniæ, cutting through the external ring is insufficient to release the protruded parts, but he must proceed with his knife obliquely outward, before he can return the swelling. For the truth of this assertion I would appeal to those surgeons best acquainted with the structure of the parts, who have performed the operation most frequently and with the greatest attention.

The mouth of the hernial sac, when it becomes the seat of stricture, has been thickened on the inner part by the pressure of the tendons of the internal oblique and transversalis muscles, and if a truss has occasioned much pressure on its outer side, the whole circle of the sac becomes thickened in consequence. Thus the cause of stricture at the mouth of the sac is occasioned by parts external to it. Moreover, though the abdominal ring be dilated with freedom, the hernia will in many cases still retain its colour of strangulation and remain as irreducible as before; but if the sac

be traced up with the knife about an inch and a half obliquely outward, the stricture will there be found, and when this is divided the intestine can be readily returned.

Strangulated hernia mostly fatal unless reduced.

Strangulated hernia is almost always fatal unless the tumour is reduced, but now and then an instance will occur of the parts sloughing off, and a fistulous opening remaining for life through which the fæces are constantly escaping. This dreadful termination of the disease leaves the patient constantly offensive, incapable of considerable exertion, and renders life itself a loathsome burden.

Strangulation terminating in sloughing.

In young persons, where the powers of life and reparation are vigorous, a hernia will sometimes slough and the aperture be closed by a natural process. Whenever any medical attendant is called to a person suffering under the symptoms which I have described above, he should carefully enquire whether his patient had any tumour descend during the day and return in the recumbent posture during the night, in the groin or in any other known seat of hernia; and he should not be content with mere enquiries, as persons are sometimes unconscious of this disease, and sometimes unwilling to acknowledge it, but he should himself carefully examine the abdomen with his hand, to discover if possible any tumour to which these symptoms may be attributed.

Cause of strangulation.

The cause of strangulation is the descent of an additional portion of intestine and omentum into the hernial sac; it might be thought that the mere protrusion of a greater length of a single fold of intestine would not increase the stricture at the narrow ring of compression; but the reason that it does so is, that a proportionally larger quantity of the mesentery descends along with the bowel, and thus increases the pressure made by the stricture upon the blood-vessels of the hernial contents.

The same causes which produce hernia renders them strangulated; such as distension of the abdominal viscera, exertion of the abdominal muscles, particularly in positions which compress the bowels on the upper part of the abdomen, and leave the lower part relaxed and the apertures unguarded; violent exertions in ex-

PLATE IV., CONTINUED.

margin of the external ring, and lost upon the tunica vaginalis at *d*.

c, Hernial sac.

d, Testicle.

e, Spine of the ilium.

f, Tendon of the external oblique muscle reflected to show the inguinal canal.

g, Abdominal ring.

h h, Poupart's ligament.

i, Internal oblique muscle.

k, Rectus.

l, Femoral artery.

m, Femoral vein.

n, Margin of the internal oblique muscle turned upward to expose the hernial sac, and epigastric artery on its inner side.

o o, The Spermatic cord is seen emerging from the internal abdominal ring behind the hernia, and taking its course through the external ring into the scrotum.

p, An incipient hernia, appearing at the inner ring, midway between the spine of the ilium and symphysis pubis.

pulling the fæces, raising a heavy weight from the ground when the body is stooping, straining to reach a great height, coughing, sneezing, and the like. Eating flatulent vegetable food, is peculiarly apt to induce strangulation. This latter cause operates by distending the intestinal canal, causing it to occupy more space than before in the abdomen, and consequently pushing out part of the viscera into the hernial sac.

A small hernia is more easily strangulated than a large one, the pressure on the contents being more violent, and the symptoms are much more urgent, as the stricture acts with more effect upon a single knuckle in stopping its circulation than when the contents of a hernia are large and voluminous; and a hernia which appears suddenly is more liable to this accident than one of long standing, which has been in the habit of frequently coming down, the aperture which admits of the descent of the latter being enlarged from repeated protrusion, while in the former it is proportionally contracted around the intestine.

Small hernia
more easily
strangulated.

LECTURE XLIII.

TREATMENT OF STRANGULATED HERNIA.

As all the symptoms which have been described in a preceding part originate from the compressed state of the protruded parts, it must be the surgeon's object to return them as soon as possible into the cavity of the abdomen, and he is only wasting time by any attempts to alleviate the violence of the symptoms independent of this principal object.

The return of the part is first to be attempted by what is termed the Taxis. This is done by making pressure with the hands upon the tumour, and at the same time placing the patient in that posture which gives as much room as possible in the abdomen and relaxes its muscles and apertures. The best position for this pur-

Taxis.

Position of the
patient.

pose is the supine, with the body moderately incurvated. This is effected by laying the patient on his back, and putting one pillow under the pelvis, and another under the shoulders, which will cause the loins to sink between them both, the thighs should be elevated to a right angle with the patient's body, and the knees should be brought so close together as only to admit of the surgeon's arm between them.

This last is a most essential point, since it relaxes the fascia of the thigh, and consequently the apertures through which the hernia quits the abdomen, which, as we have before described, is intimately connected with this fascia. The patient should also be desired to void his urine, and then to keep himself as quiet as possible.

The surgeon then places himself on the patient's right side, and embracing the tumour with his right hand, he presses it towards the abdominal ring so as to keep it from receding, then applying the finger and thumb of his left hand upon the neck of the tumour, at the part where it enters the abdomen, he gently presses it from side to side, thus endeavouring to disengage it and get a small portion of it within the abdomen. If any part can be forced up the rest generally follow without any difficulty. The pressure may sometimes be more effectually made by having some counter-force to prevent the patient's body receding.

Period of time
proper for the
continuance of
the taxis.

The pressure should be maintained from a quarter to half an hour. I have known it succeed after a trial of twenty minutes, and it should not therefore be hastily abandoned. The degree of force should be but moderate, as the chief dependence should be placed on continuance rather than violence of pressure, the latter being sometimes known to produce a laceration of the protruded parts.

The longer the hernial tumour has been strangulated, the more dangerous is it to use any considerable pressure for its reduction, as the parts have then a much less power of resistance than in their natural state. The force of the pressure should be directed towards the anterior and superior spinous process of the ilium, in

the course which the tumour takes, obliquely upwards, and not towards the abdomen immediately behind the abdominal ring.

If the attempts at reduction in the posture which I have described do not prove successful, it has been recommended to sling the patient by his knees, with his head dangling downwards over the shoulders of an assistant. This position, however, does not provide for that relaxation of the abdominal muscles which is so desirable, and it is altogether painful to the patient, and renders it difficult for the surgeon to apply proper pressure upon the tumour. From frequent experience of it by my own trials, and by witnessing those of others, I can affirm that I have never found it answer, where the other method fully and fairly performed has previously failed.

The sudden relaxation of the abdominal muscles during a fit of coughing, by taking off pressure from the viscera, together with the ascent of the diaphragm in the act of coughing, will sometimes assist in its reduction. A patient was brought into Guy's Hospital, who, during the attempt to reduce it by my dresser, Mr. Workman, was seized with a violent fit of coughing; the pressure being continued during the paroxysm, he felt the hernia suddenly recede into the abdomen.

The intestinal hernia will be found more easy of reduction than the omental. The former goes up suddenly with a gurgling noise; the latter returns gradually, excepting the last remaining portion, which does indeed rapidly slip up from beneath the fingers, but unaccompanied with any noise. If from want of elasticity in the hernia the surgeon is clear that it is merely omental, the force used for reduction may be much greater than it would be safe to employ for the intestinal species.

Intestinal hernia more easily reduced.

If a fair trial of the plan which I have just mentioned should not prove successful, other means should be resorted to. One of them is venesection, the object of which is, first, by the general languor which it occasions, to produce a relaxation of the strictured part, and next, to prevent the local inflammation from running so high

Reduction by venesection.

as to occasion mortification, which would render the case fatal though the protruded parts were returned.

The quantity of blood to be drawn should be from fourteen to twenty ounces, according to the strength of the patient's constitution. So much should be taken away as to bring on a degree of faintness, in which state of general relaxation the attempts at reduction should be repeated. A surgeon unaccustomed to the small thready pulse of a person suffering under strangulated hernia, feels apprehensive of taking away blood, conceiving the patient's strength to be fast sinking; but this fear is groundless, as the pulse becomes larger and fuller after this evacuation.

Employment of
the warm bath.

If this fail of success, the patient is usually put into the warm bath, and indeed I generally employ the warm bath immediately after the bleeding, before the second attempt at reduction by the taxis. The first heat of the bath should be one hundred degrees of Fahrenheit, and it should be gradually raised till the patient faints, or feels disposed to do so, which usually takes place in fifteen or twenty minutes. The attempt at reduction is then to be repeated.

Extreme depression
produced by
strangulation.

The depression produced by the strangulation of an intestine is sometimes so great, that very slight causes will induce a state of syncope, from which the patient is with difficulty roused.

The patient scarcely ever fails to express feeling much less pain after the bleeding and warm bath than before, at the same time that it too often happens that no advantage is gained in the essential point of reduction.

The two remedies on which, so far as my observation goes, a firmer reliance may be placed, are the tobacco clyster, and the application of cold; and if these fail I should be little inclined to await the trial of any other remedy.

Tobacco clyster.

Tobacco has been used in hernia both in form of smoke and as a liquid clyster. To use the smoke with any effect requires a complicated apparatus, and consequently it is often very badly managed; it is besides uncertain in its effects, and hence its use

has long been discontinued in the hospitals of the Borough, and in the private practice of their surgeons.

The tobacco clyster, which is by far the most convenient, is made by infusing a drachm of tobacco in sixteen ounces of boiling water for ten minutes, after which it is fit for use. But as the effect of this potent remedy varies very much in different constitutions, and perhaps according to the quality of the tobacco, it is best to inject only half that quantity at first, and the remainder half an hour afterwards, if the portion has not proved sufficient. To those who have commonly heard of two drachms being thrown up at a time without bad consequences, this may appear an useless precaution, but instructed by personal observation, I can venture to assert, that whoever practises this often will meet with effects which will lead him to repent his rashness.

Mode of administration.

I once saw a man with whom the tobacco clyster had been used in the quantity of two drachms, without a reduction of the tumour, who about half an hour afterwards was put upon a table to have the operation for hernia performed; when his pulse was found so low, his countenance so depressed, and his body covered with cold sweats, that he was ordered back to bed, and on carrying him thither, he expired.

A girl who laboured under strangulated hernia, and who was sent to Guy's Hospital by Mr. Turnbull, surgeon, had a single drachm of the tobacco in infusion injected. It produced most violent pain of the abdomen, with vomiting, in which was thrown up a quantity of matter which smelt strongly of tobacco, and she died in thirty-five minutes after the clyster had been administered, and most evidently from its effects.

Danger of the tobacco clyster.

These are my reasons for advising the above cautious manner of using this remedy; but at the same time it should be observed, that there are some persons on whom even the quantity of two drachms produces little effect.

When the tobacco acts in the manner to be desired, it produces extreme languor, a weak and quick pulse, a cold sweat, and such universal relaxation, that the patient has not the power to exert

Effects of the tobacco clyster.

any of the voluntary muscles of the body. In this state the hernia will often return into the abdomen with a very slight pressure, though it had previously resisted a considerable degree of force. I have felt a hernia, which had been previously tense, under the operation of the tobacco clyster become perfectly soft and relaxed, which state was produced, not by any partial return of its contents, as no pressure had been used, but simply by the temporary removal of the force of circulation from the protruded intestine. In some cases I have observed that the warm bath has rendered the tumour more tense, and increased its volume; probably by increasing the heart's action, determining a larger quantity of arterial blood to the intestine than the compressed veins were able to return. It is from the opposite effect that the benefit of the tobacco enema is derived; it so depresses the force of the heart, that the pulse at the wrist can scarcely be felt; and this temporary suspension of the force of circulation relieves the distended vessels of the gut, and, by diminishing its bulk, assists in its reduction.

Application of
cold.

Ice.

The other powerful method of assisting the reduction of hernia is the application of cold. To produce it, brandy and vinegar, vinegar and sal ammoniac, or simply dashing cold water upon the naked abdomen and tumour, have all been employed. The most simple and effectual, however, where it can be procured, is to apply ice. For this purpose it should be broken in small pieces, and put into a small bladder so as to half fill it, which, being tied up and wiped dry, is to be laid upon the hernia, and to cover the inflamed and swollen parts. Its effect is almost immediately to diminish the pain, to contract the skin over the tumour, and by the pressure thus produced to compel the return of the protruded contents. Another great advantage of this remedy is, that it arrests for a length of time the progress of the symptoms, so that it may be continued for several hours upon the part without incurring the risk of losing too much time. If after a trial of about four hours the symptoms become mitigated, and the tumour lessens, this remedy may be persevered in some time longer, but if they con-

tinue with unabated violence, and the tumour resists every attempt at reduction, no further trial of the ice should be made.

It is improper to apply the ice to the part wrapped up between folds of cloth, as is often done, as the melted portion constantly keeps the patient's bed wet and uncomfortable; and besides, if long continued, it produces a frost bite, and the part sloughs off. An instance of this kind occurred to Mr. Sharp and Mr. Cline, in a case which they attended in February, 1780. They directed ice to be applied to a strangulated hernia, which being continued for thirty-six hours, occasioned the integuments to freeze to the extent of four inches. The part was white and hard, but when the ice was removed, it thawed, becoming again red and warm, and soon after the hernia was reduced. The integuments which had been frozen continued red and inflamed for ten days, when they became livid, and sloughed as far as they had been frozen, but the ulcer afterwards healed without difficulty.

Mode of applying the ice.

As ice cannot be procured in many situations, some substitute for it must be had. The most convenient is a mixture of sal ammoniac and nitre, first finely powdered and mixed in equal proportions. Sixteen ounces of water being put into the bladder, ten ounces of the mixed salt is to be thrown in, and the bladder then tied up and laid upon the tumour. The degree of cold produced by this mixture is lower in the hottest weather than the freezing point of water, and if the water be previously cooled, the cold will be greater.

Substitutes for ice.

Nitrate of ammonia and water, in equal parts, produces a still greater intensity of cold; but as this salt is not used in medicine, it is not easily procured. Vinegar and sal ammoniac, and vinegar with spirit of wine, generate too slight a degree of cold to be much depended on for this purpose.

In addition to the means hitherto described, it is proper to give opium to allay the violence of the vomiting. After copious bleeding opium is of particular service, and much assists the subsequent attempts at reduction.

Opium to allay the vomiting.

With respect to cathartics, the most drastic kind were formerly

Cathartics.

employed, but they have so repeatedly been found not only ineffectual in this complaint, but positively injurious, that their use is now entirely laid aside, excepting when the symptoms are very slight. If the strangulation has produced vomiting, purgatives only increase it, for the stomach is so irritable that the medicine is rejected as soon as swallowed, and hence cannot have a purgative effect, whatever be the extent of strangulation in the intestine; and if the hernia be omental, little advantage could be derived from purgatives.

Where the symptoms are but slight, aperient medicines may be given, if there is either no vomiting or only at distant intervals. In such cases, I have known opium, joined with calomel and cathartic extract, produce stools and relieve the patient.

Fomentations.

In slight cases, fomentations and poultices may be applied with advantage; but still, even in the less urgent cases, I think them much inferior to the application of cold. In one case, in which the tumour was tense, and the scrotum much inflamed, I found the application of leeches, and the subsequent application of fomentations, occasion a return of the protruded parts.

OPERATION FOR STRANGULATED INGUINAL HERNIA.

When necessary.

When the means I have recommended have been tried, without enabling the surgeon to reduce the hernia, or relieve the strangulation, it becomes necessary that an operation should be performed, to liberate the strangulated viscus.

But little danger.

There is but little danger attending this operation, if the person upon whom it is to be performed be free from other disease. The cause of persons who have undergone this operation so frequently dying, is not to be attributed to the operation, but to the degree of mischief which has taken place previously to its being performed.

Gangrene.

When strangulation has existed for a long time, the contents of the hernia either become gangrenous, or in a state so nearly approaching to it, that they do not recover their proper functions,

otherwise inflammation extends from the strictured portion to the viscera, within the cavity of the abdomen, and thus the surgeon has to combat with a severe disease after the removal of the strangulation. The danger is therefore in the delay, and not in the operation.

Very frequently much time is unnecessarily lost, before an operation is proposed; and too much cannot be said in condemnation of such practice. A patient is submitted again and again to the taxis, and the swelling is rendered extremely tender, by being so often compressed, in the hope of avoiding an operation, until at length the rapid increase and urgency of the symptoms point out the impropriety of such delay; and an operation is performed when but little prospect of success remains. Danger of delay.

It is extremely important that the operation should, if possible, be performed before the abdomen becomes tender under pressure. Distension of the intestines from flatus, often produces tension of the abdomen, soon after strangulation has occurred; but still the patient can bear pressure without experiencing pain; but when he does complain of pain under pressure, it indicates the extension of inflammation to the cavity of the abdomen, which is likely to be much increased by the operation.

In this state there is peritoneal inflammation to contend with, which, unfortunately, the operation itself, though the only method of removing the stricture, is calculated to increase; so that on opening the cavity of the abdomen, this inflammation spreads through its cavity and destroys the patient. Peritoneal inflammation.

Therefore as soon as bleeding, the warm bath, the tobacco dyster, and topical cold, have been fairly tried, and have proved unsuccessful, if the abdomen is becoming affected, the operation should be no longer delayed; and, indeed, if the warm bath cannot be conveniently and quickly procured, it is better to omit it altogether, than to endanger the patient's life by further delay. Symptoms indicating the necessity of an operation.

This soreness upon pressing the abdomen is a much better criterion than the time which has elapsed since the occurrence of the first symptoms of strangulation, for there is the utmost variety in

the time that elapses between these symptoms and a fatal termination. There is a drawing of a large intestinal and omental hernia in the museum at St. Thomas's Hospital, which Mr. Ede used to state in his lectures proved fatal in eight hours from the first appearance of strangulation; under these circumstances death is not occasioned by mortification, but by the constitutional irritation which the inflammation of so large a surface occasions. On the other hand, I have known the operation successfully performed at the end of eight days after the accession of the symptoms of strangulation, although death generally happens on the sixth or seventh day from the commencement of the symptoms. I have known an instance of fatal termination within three days from the descent of the rupture.

Some judgment may be formed from the pulse, and from the patient's general appearance; if the pulse be so small as to be scarcely perceptible, and the countenance anxious and sunken, no time is to be lost; but even under these circumstances, and with hiccough superadded, I have known the operation succeed.

Indeed there is scarcely any period of the symptoms which should forbid the operation; for even if mortification has actually begun, the operation may be the means of saving life by promoting the ready separation of the gangrenous parts, and relieving the distended intestine.

Patient's assent
to an operation.

It will be said that it is difficult to obtain the patient's consent to an early operation; but this I have never found, where the precise state of the case was represented. The almost certain fatal consequence of delay, and the inconsiderable degree of pain which is inflicted in this, compared with many other operations, seldom fail to gain the patient's consent of submitting to the only remaining method of relief from his sufferings and his dangerous situation.

Progress of in-
flammation va-
ries.

The progress of inflammation, and extent of mischief, are not always in proportion to the time that strangulation has existed, for the period between the commencement of the symptoms, and the fatal termination, varies exceedingly.

A large hernia when completely strangulated, is more quickly fatal than a smaller one; but the latter more frequently requires the performance of an operation, on account of the greater firmness of the stricture. Small herniæ more frequently require operation.

A hernia containing a portion of strangulated intestine alone, is more rapidly fatal than one containing omentum only; and that containing both intestine and omentum, takes a middle course between the two above mentioned. Intestinal hernia most dangerous.

When a hernia has existed for a long time, and becomes strangulated, the attempts at reduction will be more likely to succeed than if it were of recent formation; in the first instance, the parts are more easily relaxed, having been accustomed to repeated dilatation; while in the latter case, the powers of resistance are much greater. Old herniæ most likely to be reduced.

Also in very young, or very old persons, strangulated herniæ are more frequently reduced, than when they occur at the middle period of life, during which the fibrous structure is firmer, and the muscular strength greater than at any other period. In very old persons, also, the strangulation is not so rapidly fatal; as long a period as twenty days has been known to elapse between the commencement of the symptoms, and the death of the patient. Also in very old or young persons.

EXPLANATION OF PLATE VII.

This Plate represents on the right side a small oblique inguinal hernia, making its appearance at the internal ring, on the outer side of the epigastric artery; and on the left side a scrotal hernia, with its coverings displayed by dissection.

a a. Fascia superficialis coming from the external abdominal ring, and forming the external investment of the hernia. At its upper part the transverse fibres of the external ring are seen.

b b b. Cremaster muscle thickened—seen descending under the

margin of the external ring, and lost upon the tunica vaginalis at *d*.

- c.* Hernial sac.
- d.* Testicle.
- e.* Spine of the ilium.
- f.* Tendon of the external oblique muscle reflected to show the inguinal canal.
- g.* Abdominal ring.
- h h.* Poupart's ligament.
- i.* Internal oblique muscle.
- k.* Rectus.
- l.* Femoral artery.
- m.* Femoral vein.
- n.* Margin of the internal oblique muscle turned upward to expose the hernial sac, and epigastric artery on its inner side.
- o o.* Spermatic cord is seen emerging from the internal abdominal ring behind the hernia, and taking its course through the external ring into the scrotum.
- p.* An incipient hernia, appearing at the inner ring, midway between the spine of the ilium and symphysis pubis.

OF THE OPERATION FOR INGUINAL HERNIA.

Preparatory steps.

Previous to the operation, the patient should be directed to empty his bladder, and the integument upon the tumor and surrounding parts, must be cleansed from the hair usually covering it.

Position of the patient.

The patient is then to be placed upon a table, about three feet six inches in height, on his back, the shoulders should be raised, and the thighs a little flexed towards the body, so as to relax the abdominal muscles; the hams are to be brought to the edge of the table, so that the legs may be allowed to hang over it.

The surgeon should now place himself between the patient's thighs, and grasp the tumor with his left hand, so as to put the integument covering it upon the stretch, and then having a scalpel in his right hand, he should commence the operation by making an incision through the skin, on the anterior part of the swelling, which incision should be begun opposite the upper part of the external abdominal ring, and carried down to the inferior part of the tumor, unless the swelling be of a large size. Besides the skin and cellular substance, the external pudendal artery may be divided by this incision, as it always crosses the sac near the abdominal ring. The hæmorrhage from this vessel may usually be stopped by pressure; but if very troublesome, it will be necessary to put a ligature upon it. Operation.

By this incision the fascia of the cord becomes exposed, which generally forms the thickest covering of the hernia. This must be carefully cut through in the centre, so as to admit the entry of a director which is to be passed under the fascia, upwards to the ring, and downwards to the extent of the external incision, that the fascia may be safely divided upon it. Fascia of the cord exposed.

Thus the cremaster muscle is brought into view, forming the next covering, which must be opened and divided in the same manner as the fascia, and with equal care, and the cellular tissue beneath must be cautiously cut through. Cremaster exposed.

When this has been completed, the hernial sac itself is laid bare, and the surgeon must proceed with the utmost caution to open it in the following manner. He first nips up a small portion of the membrane on the anterior and inferior part of the tumour, between his fore-finger and thumb of the left hand, and slightly rolling the membrane between them, he easily distinguishes if any intestine or omentum be included; and if so, he raises a fresh portion. Being satisfied that he has only a part of the sac raised, he is to place the edge of the knife horizontally against it, and make an opening of sufficient size to admit the end of a director, which is then to be introduced, that the sac may be opened upon it. Hernial sac exposed.

In dividing the different coverings, a very cautious operator will Caution in dividing the coverings.

make more layers than I have described, being fearful of doing mischief which might be irreparable.

Appearance of the sac.

When the hernial sac is exposed, it has usually a bluish tint, and is semitransparent. If the contents be not adherent to the sac, it generally contains a quantity of fluid, and a sense of fluctuation may be usually perceived at the inferior and anterior part of it, for which reason this part should be first opened, as the intestine is there in the least danger.

Escape of fluid.

Immediately the sac is opened, this fluid escapes. If the strangulation have not existed long, it is occasionally of a serous colour, but more frequently of a darker, or coffee colour, and sometimes it has an offensive smell.

Quantity of fluid.

This fluid is most abundant in intestinal hernia, and is in quantity in proportion to the bulk of intestine strangulated. If, however, the hernia be omental, or if the intestine adhere to the interior of the sac, little or no fluid is found, so that it must not always be looked for as an indication of the sac being opened.

Sac opened.

The sac being opened, the surgeon is enabled to see its contents, which he must attentively examine. If both intestine and omentum have been strangulated, the latter is found above and anterior to the former; in some instances covering the gut partially, in others completely.

Appearance of omentum or intestine.

If the hernia has not been long strangulated, the omentum has much of its usual character, being only a little darker than natural, and having its veins distended; but the intestine is found covered with a thin coat of adhesive matter, and is of a red colour. When the strangulation has existed for a long time previous to the operation, or when the stricture has been unusually tight, the intestine presents a dark brown chocolate colour.

Seat of stricture ascertained.

The surgeon should now pass his finger into the hernial sac, and examine accurately the seat of the stricture, which he will find in one of the three following situations:—

First.—At the internal abdominal ring, in the mouth of the sac.

Second.—In the inguinal canal, an inch, or an inch and a half within the external ring.

Third.—At the external ring.

The most frequent seat of stricture is at the internal abdominal ring, from an inch and a half to two inches above, and outwards from the external ring, and it is occasioned by the pressure of the internal oblique and transversalis muscles upon the mouth of the hernial sac, which becomes thickened, more especially on its pubic side.

At the internal ring.

Should the stricture be situated at this part, it has been thought necessary to divide the external ring, and to slit up in part the inguinal canal, by dividing a portion of the tendon of the external oblique muscle, in order to give the operator a distinct view of the protruded parts, and to enable him to divide the stricture without danger to his patient. This may be done by passing the finger into the sac, through the external ring, as far as the seat of stricture, and then introducing a curved bistoury with a probed extremity between the upper part of the finger and the sac, and cutting through the tendon, superficial fascia, and integument, forming the anterior boundary of the inguinal canal.

How exposed.

Having thus exposed the contents of the hernial sac as far as the seat of stricture, the operator should insinuate the point of his finger, or a director, under the stricture, between the sac and its contents at the upper part, carefully keeping the latter from turning over the finger or director. He should then pass the knife for dividing the stricture upon the finger or director, under the stricture, and by a gentle motion divide the stricture in a direction parallel with that of the linea alba, and to an extent sufficient to allow the finger to be easily passed into the cavity of the abdomen. The knife should then be withdrawn in a careful manner. In this case I have adopted with advantage the following plan:—The sac being opened to the external ring, I have put my finger into it, and hooked down the sac; I have then directed an assistant to draw up the tendon of the external oblique at the ring, and have thus been able to bring the stricture into view without cutting the tendon of the external oblique to the upper ring.

Division of the stricture.

The knife best adapted for dividing the stricture is blunt at its

Knife for dividing the stricture.

extremity for about a quarter of an inch, sharp for half an inch, and then again blunt, only cutting so far as is necessary to divide the stricture, without endangering the neighbouring parts.

I have occasionally practised, and have for some time recommended in my lectures, the following mode of dividing the stricture without including the sac. The tendon of the external oblique having been divided a little above the external ring, the sac is gently drawn down, while the muscles are drawn up by an assistant. In this way the stricture is brought into view, and can be divided without risk, and without including the peritoneum. I was led to adopt this by the result of a case, in which I had reason to doubt whether the aperture in the intestine was not caused by the knife; when the stricture is not in view, the intestines cannot be completely secured from danger; the knife is passed blindly upon the finger as a guide, and in dividing the stricture has been known to wound the intestine.

An advantage is derived from dilating the stricture without cutting the sac itself, for there is no danger of injuring the intestine with the naked edge of the knife, which I have twice known to happen when the stricture was divided from within the sac; in one case the patient died from the contents of the intestine escaping into the abdomen, in the other the intestine was obliged to be retained in the sac to allow of the escape of the fæces by the external wound. An additional advantage is derived from this method of dilatation, viz. that if by any mistake of the operator the epigastric artery is cut, as the peritoneum is undivided, the flow of blood would be immediately perceived, and then the vessel might be secured; whereas if the sac is included in the incision, the artery would bleed into the abdomen, and the consequences might be fatal, without the cause being known but by dissection.

Stricture in the
inguinal canal.

The second seat of stricture is in the inguinal canal, and is formed by the sac itself in the following way:—a person becomes the subject of oblique inguinal hernia, and the pressure on the neck of the hernial sac at the internal ring, creates a thickening of

Plate V.

Fig 1

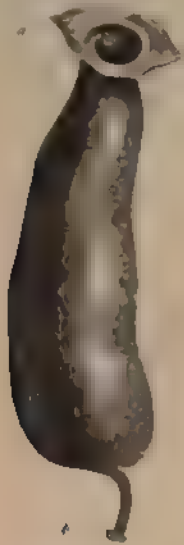


Fig 3

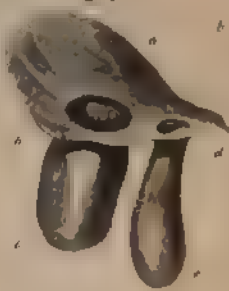


Fig 2



Fig 1



PLATE V.

Fig. 1. Shews a sac taken from the body of a person who laboured under an inguinal hernia.

a, Its mouth.

b, The course of the vas deferens behind it.

Fig. 2. This gives a view of a hernial sac, which has passed no further than the abdominal ring, so that the whole of the sac is included between the abdominal ring, and the place at which the spermatic cord quits the abdomen.

a, Abdominal ring.

b, Poupart's ligament.

c, Iliac artery.

d, Femoral artery.

e e, Epigastric artery passing behind the mouth of the sac.

f f, Spermatic cord passing behind the sac, and through the abdominal ring, to the testis.

g, The testis.

h, Mouth of the hernial sac.

i, The fundus of the sac, which just reaches the abdominal ring.

Fig. 3. Shews two sacs, one by the side of the other; the one contracted by wearing a truss so as to be no longer capable of receiving the viscera; the other larger, and forming by the side of the first.

a, The peritoneum.

b, Mouth of a newly formed sac.

c, Its fundus.

d, Contracted mouth of an old hernia.

e, Its fundus.

Fig. 4. An omental and intestinal hernia, irreducible from adhesion; and membranous bands extending across the hernial sac.

a, Abdominal ring.

PLATE V., CONTINUED.

***b b*, Columns of tendons forming the ring.**

***c*, Transverse tendinous fibres passing to the two columns.**

***d*, Tunica vaginalis.**

***e*, Epidydimis.**

***f*, Testis.**

***g g*, Fascia coming from the abdominal ring to cover the hernial sac.**

***h h*, Hernial sac.**

***i i*, Membranous bands crossing the sac.**

***k*, A piece of whalebone to keep the sac extended.**

***m*, Intestine adhering to the sac.**

***n n*, Omentum also adhering to the sac.**

the sac at this part. From any sudden exertion or straining, which occasions a further protrusion, this part of the sac is forced into the inguinal canal, and when the patient is in the recumbent position, part or the whole of the contents of the sac being returned into the cavity of the abdomen, the portion of the sac which had been previously situated at the internal ring, and had been thickened, again takes its former position. This occurs again and again; but at length the sac becoming elongated, the thickened portion, which had been originally placed at the internal ring, no longer returns to this situation when the contents of the sac are reduced; but it remains in the inguinal canal, and may here at any future time be the cause of strangulation.

When the stricture is thus formed, the surgeon should freely expose the contents of the hernial sac as far as the stricture, and then divide it in the same manner, and in the same direction as before described.

How exposed
and divided.

Sometimes, but rarely, the seat of stricture is at the external abdominal ring, in which case the same plan of dividing the stricture should be adopted; but it is not necessary to make so large an opening.

Stricture of the
external ring.

If the hernia be direct, it is to be remembered that the spermatic cord is placed on its outer side. It is covered by the fascia of the cord, by the cremaster partially, and is contained in a sac formed by the tendon of the transversalis muscle, assisted by the fascia transversalis, besides a peritoneal sac, as in other hernia.

The division of the stricture directly upwards is then applicable to every common case of strangulated inguinal hernia, whether oblique or direct; it is equally safe with any other division that has been proposed, and the operation is by it more simplified than by adopting a different mode of dividing the stricture for each variety.

Best direction
for dividing the
stricture.

EXPLANATION OF PLATE VIII.

Fig. 1. Shews a sac taken from the body of a person who laboured under an inguinal hernia.

- a.* Its mouth.
- b.* The course of the vas deferens behind it.

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- a.* Abdominal ring.
- b.* Poupart's ligament.
- c.* Iliac artery.
- d.* Femoral artery.
- e e.* Epigastric artery passing behind the mouth of the sac.
- f f.* Spermatic cord passing behind the sac, and through the abdominal ring, to the testis.
- g.* The testis.
- h.* Mouth of the hernial sac.
- i.* The fundus of the sac, which just reaches the abdominal ring.

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- b.* Mouth of a newly formed sac.
- c.* Its fundus.
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- e.* Its fundus.

Fig. 4. An omental and intestinal herniæ, irreducible from adhesion; and membranous bands extending across the hernial sac.

- a.* Abdominal ring.

- b b.* Columns of tendons forming the ring.
- c.* Transverse tendinous fibres passing to the two columns.
- d.* Tunica vaginalis.
- e.* Epidydimis.
- f.* Testis.
- g g.* Fascia coming from the abdominal ring to cover the hernial sac.
- h h.* Hernial sac.
- i i.* Membranous bands crossing the sac.
- k.* A piece of whalebone to keep the sac extended.
- m.* Intestine adhering to the sac.
- n n.* Omentum also adhering to the sac.

EXPLANATION OF PLATE IX.

Different views of preparations of inguinal herniæ, intended to shew the mode of operating on each variety.

Fig. 1. *a a a.* Tunica vaginalis.

- b.* Testis.
- c.* Spermatic cord.
- d.* Hernial sac within the tunica vaginalis.
- e.* Mouth of the sac, which has been produced by an adhesion of the tunica vaginalis, opposite the abdominal ring.
- ff.* Intestine.

Fig. 2. *a.* Strangulated intestine, the sac cut open.

- b.* The adhesions of the tunica vaginalis to the mouth of the sac.

Fig. 3. Common inguinal hernia.

- a.* Abdominal ring.
- b.* Poupart's ligament.
- c.* Femoral artery.
- d.* Epigastric artery.
- e.* Hernial sac below the ring.
- f.* Hernial sac above the ring.

- g.* The sharp part of the knife introduced between the ring and the sac, with its side placed towards the sac; its edge is to be turned forwards to divide the ring.

Fig. 4. Hernia on the inner side of the epigastric artery.

- a.* Abdominal ring.
- b.* Poupart's ligament.
- c.* Femoral artery.
- d.* Epigastric artery.
- e.* Internal oblique and transverse muscles passing over the sac.
- f.* Tendon of the transverse muscles passing under it.
- g.* Fascia from Poupart's ligament, from which the cord has been withdrawn, to shew the place through which it passes.
- h.* Hernial sac.
- i.* Hernial sac above the ring.
- k.* Knife introduced to shew the manner of dilating the stricture, which is to be always done forwards and upwards opposite to the middle of the mouth of the hernial sac, in all the varieties of inguinal hernia, excepting when the spermatic cord is on the anterior part of the mouth of the sac, when the division should be made outwards.

Cutting upwards is necessary in the variety shewn in Fig. 4, as dividing outwards towards *e* would divide the epigastric artery.

LECTURE XLIV.

Examination of viscera.

AFTER having sufficiently divided the stricture, the surgeon should carefully examine the protruded intestine, particularly that part which has been immediately under the stricture, and ascertain whether the circulation becomes restored, which he may do by

employing pressure to empty the vessels, and then observe if they be again immediately filled.

Should the circulation be free, he should then gradually and very carefully return the intestine by small portions at a time, until the whole is reduced. At this time the patient should be placed much in the same position as when the taxis is employed.

When adhesions have taken place between the intestine and sac, Adhesions. great care is required in opening the latter, as little or no fluid exists in it, to separate it from the intestine, which may be in consequence easily wounded. The sac being opened, if the adhesions be found long, and not very numerous, they may be divided to allow of the return of the protruded part. Sometimes these adhesions are only found at the mouth of the sac, or are otherwise partial; in either case they should be carefully separated, that the hernia may be completely reduced; but the division of such adhesions, particularly at the mouth of the sac, is attended with considerable danger. Sometimes the sides of the fold of intestine which has been strangulated are found glued together: in this case it is best to separate such adhesion, if it can be easily done, as the free passage of the fæces is afterwards interrupted, if the intestine be returned doubled back into the abdomen with such adhesion remaining.

Should the intestine be gangrenous, it will be indicated both by the constitutional symptoms of the patient, and the change which the hernial tumour itself undergoes. The pulse becomes fuller and softer than during the inflammatory stage, but is often intermittent; the hiccough and tension of the abdomen still continue, but the vomiting is less frequent. The patient expresses himself comparatively free from pain, and leads the unwary practitioner to consider his symptoms as more favourable; the glassy eye is also a general attendant upon gangrene. The tumour, which was tense and elastic, becomes soft and doughy; the skin, which was at first red, assumes a purple hue; the cellular membrane of hernial coverings becomes emphysematous, and gives a crackling sensation under the fingers. The hernia will now sometimes return into the

Symptoms of
gangrene end-
ing in artificial
anus.

cavity of the abdomen with little or no effort on the part of the surgeon, which dooms the patient to a speedy death. Sometimes the integuments slough and ulcerate, the intestines give way, and the fæcal contents escaping from the opening, the symptoms of strangulation cease. An artificial anus thus becomes sometimes established, through which, frequently during the remainder of the patient's miserable existence, the fæces are discharged.

Treatment when
sloughing takes
place.

With respect to the treatment that is required for these cases of sloughing hernia, I believe that very little more can be done than to hasten the process of separation by fomentation and poultices, and to support the strength of the patient by generous diet and tonic medicines; and, that any attempt to lead the fæces into their natural passage before the sloughing process is completed, will only irritate the parts, interfere with the regular process of separation, and endanger the life of the patient.

Intestine some-
times ruptured
by violence.

So much violence, is not unfrequently used, in the attempts to reduce the hernia, that the coats of the intestine give way under the taxis, and the operator, on opening the sac, discovers an aperture, from which fæcal matter issues. A small wound may be inflicted upon the gut, by the knife of the operator, from want of caution in dividing the stricture, or from neglect of the advice which I have given, namely, to bring the stricture into view, by drawing the sac gently down while the abdominal muscles are held up by an assistant. When this accident occurs, and the aperture in the gut is very small, the surgeon is to employ a different mode of treatment from that required for gangrened intestine; the indiscriminate use of one kind of treatment would subject the patient in the present case to the risk of a fæcal fistula, which by the following expedient, may be altogether avoided. The aperture, with a small portion of the surrounding gut, should be pinched up with a pair of forceps, and a fine silk ligature being passed around it, should be secured so as to include the ruptured spot; the intestine should then be returned to the mouth of the sac.

Application of a
ligature.

Appearance of

It will sometimes happen that the intestine may appear, during

the operation, free from the usual marks of gangrene, and yet in a few days the fæces will be discharged from the wound ; this will occur when the strangulation has gone so far that the intestine cannot recover its circulation after being returned into the abdomen ; it is advisable, under such doubtful circumstances, to replace the intestine at the mouth of the sac, that the fæces may be readily evacuated at the wound as soon as the gangrenous portion begins to separate by the ulcerative process.

the intestine may deceive.

Should the intestine be in a state of gangrene, it will have a foetid smell, the peritoneal surface will have lost its brilliancy, and be of a dark port wine colour, with greenish spots on it ; it will not possess any sensibility, and will easily give way under slight pressure.

Intestine gangrenous.

Under these circumstances, the stricture should be divided in the manner I have described, after which, a free incision should be made into the gangrenous intestine, to allow of the escape of its contents, and then it should be returned to the upper part of the sac, the wound should be left open, and a poultice applied ; but if the portion of intestine which has descended be not large, it should not be disturbed from its adhesions to the sac.

Treatment of gangrenous intestine.

I was requested during the absence of Mr. Chandler, to operate upon a woman who had been admitted into St. Thomas's Hospital, under his care, with strangulated hernia. From the examination of the part, and from the history of the case previous to my seeing the patient, I imagined that gangrene had commenced, and I soon found this opinion to be correct ; for, before I had opened the hernial sac, there was a highly offensive and putrid smell. On opening the sac, I found the intestine in the state I have before described ; I therefore divided the stricture, and then made an incision of about an inch and a half in extent, on the anterior part of the gangrenous intestine, through which the fæces readily escaped. I afterwards directed that a poultice should be applied. Fæculent matter continued to be discharged through the wound ; but nine days subsequent to the operation she had a stool, per anum, after which the patient passed her stools by the natural

Case.

passage, occasionally at first, then more frequently, as the artificial anus and wound closed, and she completely recovered. This patient was confined five months after the operation, and delivered of a full grown but dead child, by Mr. Brown, a respectable surgeon at Rotherhithe. It is extraordinary, that being considerably advanced in her pregnancy at the time of the operation, she did not miscarry.

Termination
without an
operation.

When a patient with strangulated hernia will not submit to the operation necessary for his relief, or if the proper assistance cannot be procured, and gangrene takes place, the hernia sometimes suddenly returns into the cavity of the abdomen, and the patient survives only a few hours. Sometimes the skin and other coverings inflame and slough, when the fæces are discharged through the opening thus produced, and the symptoms of strangulation subside, after which an artificial anus is formed, rendering the remainder of the patient's life miserable.

Artificial anus.

Occasionally, however, it happens that the external wound and artificial anus are gradually closed, and the patient entirely recovers.

Case.

A case of this kind occurred under the care of my friend, Mr. John Cooper, surgeon, of Wotton Underedge, Gloucestershire. He was requested to attend a poor woman, aged sixty, who was the subject of strangulated crural hernia. When he first saw her, she had been labouring under symptoms of strangulation for a fortnight, and the hernia was evidently in a state of mortification. Thinking, therefore, that there would not be any chance of saving her life by an operation, he only directed that her strength should be supported, and the part poulticed. In a few days the mortified parts began to separate, and the fæces were discharged through the wound. This continued for three months, during which period several inches of one of the small intestines sloughed. After this, a small quantity of fæces began to pass by the natural channel, and in six months the woman had perfectly recovered.

Danger of arti-
ficial anus.

The formation of an artificial anus is dangerous, according to its situation in the intestinal canal. If the opening be near to the

stomach in the jejunum, the patient will die in consequence of the small surface for the absorption of chyle being inadequate to produce sufficient nourishment. If the opening be in the lower part of the ilium, or in the colon, then the patient may recover, as there is but little interruption to nutrition.

A man about fifty years of age was admitted into Guy's Hos- Case. pital with a strangulated umbilical hernia, which sloughed, and occasioned an artificial anus. As he was recovering from the effects of the strangulation and sloughing, and was allowed to take food in any considerable quantity, it was observed that part of what solids he ate passed out at the artificial anus, within half an hour after he had swallowed them, and that fluids passed out in ten minutes after they had been taken into the stomach. Although he took sufficient food to support a healthy person, he wasted rapidly, and died in three weeks. On examining his body after death, and tracing the jejunum, the lower part of that intestine was found entering the hernial sac, and in it the opening was situated. The other viscera were healthy.

When an artificial anus has been formed, care must be taken to guard against any inversion of the intestine at the artificial opening, as such an occurrence will most likely prevent the perfect recovery of the patient, by rendering the false opening per- From inversion of the intestine.
manent.

A patient of Mr. Cowell's, in St. Thomas's Hospital, underwent Case. the operation for a strangulated hernia; the intestine was found to be gangrenous, and the consequence was the formation of an artificial anus. For three weeks after the operation, the fæces passed in part by the artificial opening, and in part by the natural aperture, but most by the latter; at this period the intestine became inverted, and protruded at the artificial opening; after which the fæces were entirely discharged by the false passage. The man lived eleven years after this, but always discharged his stools by the artificial anus.

If a portion of the colon has been strangulated, and the patient be fat, the appendices epiploicæ are sometimes found much more Appendices epiploicæ removed.

diseased than the intestine, so much so that it becomes necessary to remove them, which I have had occasion to do.

Examination of omentum.

Having returned the intestine, the surgeon should carefully examine the omentum, and if it be not in a large quantity, or of an unhealthy appearance, it should be returned into the abdomen, with as gentle a pressure as possible. If a very large portion of omentum be protruded, a part should be removed, which may be done without any danger to the patient by means of the knife; and, if any arteries sufficiently large to afford a troublesome hæmorrhage, are divided, they must be secured by fine ligatures; the divided surface should then be returned to the mouth of the sac, so as to form a plug, and the ligatures should remain hanging from the external wound.

Use of the ligature abandoned.

The old mode of applying a ligature around the protruded portion of the omentum to occasion it to slough off, is now, I believe, entirely abandoned; and it appears extraordinary that it should ever have been adopted, as it is the object of the operation to remove the stricture, which would be thus immediately restored with increased severity.

Omentum mortified.

If the omentum be in a state of mortification, which may generally be known by its crispy feel, and the distension of its veins by coagulated blood; or even if any suspicion arise of its being in an unsound state, it should be removed by excision at the sound part. In doing this, the strangulated portion should be drawn down a little, so as to expose some of the sound part, which should be held by an assistant to prevent its sudden retraction into the abdomen, while the surgeon cuts off the diseased part; and when this has been completed, any bleeding vessels should be secured as before directed. Should the omentum, in an unsound state, approaching to gangrene, be returned into the cavity of the abdomen, the danger of the patient will be much increased.

Sloughing of Omentum. Case.

I have, however, known a patient recover, in whom sloughing of the omentum took place after it had been returned into the cavity of the abdomen. This occurred in a man who had undergone the operation for a strangulated hernia in Guy's Hospital.

The sac contained both intestine and omentum; and the latter, although much changed in appearance, was returned into the abdomen. Some days after the operation, the man appeared to be dying; the ligatures, holding the edges of the wound together, were removed, and poultices and fomentations employed, when, on the following day, a portion of gangrenous omentum was found protruding from the wound, and for several days more continued to present itself, until the whole of the portion which had been previously strangulated was exposed, and gradually sloughed off; after which the patient recovered.

When the omentum alone adheres to the sac, it may be freely separated and returned, any vessels likely to afford a troublesome hæmorrhage being previously secured.

Omentum
adherent.

Should the protruded omentum be much hardened, or have a scirrhus feel, it should also be removed in the same manner as I have already described.

Omentum hard
like scirrhus.

TREATMENT AFTER THE OPERATION.

When the contents of the hernial sac have been returned into the cavity of the abdomen, the wound should be well cleansed, and its edges should be afterwards brought into contact by means of sutures, in order to promote adhesion; two or three sutures being necessary, according to the extent of the wound. Care should be taken in passing these sutures only to include the integument, otherwise, by penetrating the sac, much subsequent mischief may arise.

Employment of
sutures.

The approximation of these parts should be assisted by the application of slips of soap plaister, and a compress should be placed over the wound, and retained there by means of a T bandage, to close the orifice of the sac, and prevent any further protrusion into it, and at the same time the scrotum should be well supported.

Of plaister.

The patient should then be carried to bed in a horizontal po-

Position in bed.

sition, and placed with his shoulders a little elevated, and the thigh, on the same side as the wound, moderately flexed towards the abdomen.

Necessity of the recumbent position.

As it is perfectly necessary that the patient should keep the recumbent position during the cure, a folded sheet must be placed under him, into which he should discharge his stools, otherwise, should he rise to use the night-chair, much mischief may arise from the effort. Mr. Cline had operated upon a patient for strangulated hernia; and some hours after the operation the patient got out of bed to use the night-chair, and from the exertions he made in getting up and in passing his motion, the intestine, which had been reduced, again descended into the sac: Mr. Cline again reduced the intestine, and gave strict orders for the man to keep the recumbent position, and the patient ultimately did well.

Case.

Usually, if the patient be left to himself, he will have some natural stools in a few hours after the operation; but, if several hours elapse without an evacuation, either castor oil or sulphate of magnesia should be given, or a purgative enema, containing colocyath, or castor oil, should be thrown up, and the abdomen should be fomented with spirituous fomentation, which will assist the action of the bowels, and afford much comfort to the patient.

Medicines.

As the safety of the patient depends much upon procuring evacuations from the bowels, the exhibition of opium soon after the operation should, if possible, be avoided; but if the irritability of the stomach continue, or if the patient have a troublesome cough, it should be administered in conjunction with calomel.

Purgatives.

It is not only necessary to procure evacuations from the bowels soon after the operation, but it is extremely desirable to keep up a free action upon them for several days following; as I have frequently known patients die in a few days after the operation with constipation and peritoneal inflammation, although they had passed several stools within twenty-four hours after the strangulation had been relieved.

Sutures removed.

Should the patient go on well, the wound should be dressed on

the third day, and afterwards daily. The sutures may be removed on the fourth and fifth day; but the patient must be kept in bed until the wound is entirely closed.

When the operation has been performed at an early period after the strangulation has taken place, the patient generally does well; but when much time has elapsed from the strangulation of the hernia before the performance of the operation, dangerous symptoms frequently arise. Operation successful.

Sometimes the intestine does not recover its function, when the vomiting and constipation continue, and the patient dies. Sometimes not.

Sometimes peritoneal inflammation continues, in which case the abdomen is extremely tender and tense, although the bowels are open, and the life of the patient is soon destroyed. The best means of relieving this inflammation are by local and general bleeding, fomentations, purgatives, and extremely low diet. Peritoneal inflammation.

Occasionally the patient is attacked with a violent diarrhoea, which continues for many days, producing so great a state of debility as to prevent recovery. In such cases, the treatment I have found most efficacious, consists in exhibiting small doses of opium frequently, and the employment of injections of starch and opium, with a light but nutritious diet, as gruel, or milk, with isinglass, &c. Diarrhoea.

In a few instances I have known a troublesome hiccough continue for several days after the operation, but entirely unconnected with gangrene, being the result of peritoneal inflammation. Hiccough.

The most remarkable example of this kind I ever met with, was in a gentleman at Maidstone, for whom I performed an operation upon a large strangulated intestinal hernia. The symptoms had been unusually severe, and inflammation had taken place in the peritoneum. The abdomen continued tender to pressure for several days after the operation, and the hiccough continued until the sixth day. The patient was bled and purged freely, and he eventually recovered. As this symptom depends upon inflammation of the peritoneum when gangrene has not taken place, the proper means of relieving it are the same as directed for the in- Case.

flammation of this membrane, as local and general bleeding, purgatives, &c.

The operation does not prevent a future protrusion.

The performance of the operation for strangulated hernia does not prevent the future descent of the intestine or omentum, but perhaps renders the patient more liable to its recurrence, as the mouth of the sac is by the operation considerably enlarged. It is, therefore, perfectly necessary before the patient be allowed to get up, or use any exertion, that he should be fitted with a truss, which will effectually prevent any protrusion, by keeping the mouth of the sac closed, otherwise he may in a short time again become the subject of strangulated hernia.

Truss to be again applied.

When the truss is first applied, a dosil of lint should be placed under the pad, to protect the recently healed wound.

Removal of the sac recommended.

In consequence of a radical cure not being produced by the operation I have described, some persons have recommended the removal of the hernial sac by excision or ligature, or that it should be returned into the abdomen.

Case.

In a patient of Mr. Holt's, at Tottenham, I had an excellent opportunity of seeing the effects of removing the sac by excision. A woman who, for several years, had been subject to a femoral hernia, applied to Mr. Holt, on account of the swelling having become so painful and tender as to prevent her from following her ordinary occupations, although the bowels appeared to act very regularly. Mr. Holt requested me to visit the patient with him, and I made many ineffectual attempts to reduce the hernia, and in a few days afterwards I recommended Mr. Holt to operate, as the symptoms had not in the least subsided. On opening the hernial sac, a small portion of intestine was found at the mouth of the sac, inflamed, and adherent to it. Mr. Holt carefully separated the adhesions, and returned the intestine into the abdomen. The sac itself being but little attached to the surrounding parts, I requested Mr. Holt to allow me to remove it, which I did, close to the mouth of the sac. I then closed the orifice by sutures, and the external wound was treated in the usual way. On the sixth day, the ligatures came away, and the wound was closed on the tenth. I saw

this woman a month after the operation, when she had a hernia nearly as large as the one for which the operation had been performed, and at the same spot; she was subsequently obliged to wear a truss constantly, to prevent the protrusion of this hernia.

From this it appears that the removal of the sac will not prevent the re-formation of a hernia, nor do I think, upon reflection, that it scarcely could be expected to do so, as the aperture from the abdomen remains equally large, and the peritoneum alone offers resistance to the formation of another hernia, and this had been insufficient to prevent the protrusion of the first.

Removal of the sac not successful.

The removal of the sac by ligature is equally objectionable, even if it could be done without risk, which it hardly could, more especially in oblique inguinal hernia, as the ligature ought, in such cases, to be applied close to the internal ring, which could not be done without a very tedious and hazardous dissection; besides, the spermatic cord is sometimes divided by the sac, which would increase the difficulty and danger of such an operation.

Objection to removal of the sac by a ligature.

The great danger of this operation is in the inflammation, which is likely to be induced by the action of the ligature upon the peritoneum, and in this inflammation extending to the cavity of the abdomen.

Danger of.

OF LARGE HERNIÆ.

In very large inguinal herniæ a very different mode of operating is required, to that which I have already described, for the following reasons:—

Different operation required.

When a large hernia has existed for some time, the cavity of the abdomen becomes diminished, from the habitual loss of a large portion of its natural contents, and such a resistance is offered when any attempt is made to return the contents of the hernial sac, that the intestine sometimes gives way, or is lacerated from the violence employed in attempting to reduce it, and even if it can be returned, the slightest exertion will occasion a further protrusion.

Difficulty of reducing.

Danger from
the taxis.

Also, in large hernia, a considerable extent of protruded intestine being submitted to much violence in the attempt to reduce it, often gives rise to inflammation, which may produce fatal consequences.

Extensive ad-
hesions.

Sometimes extensive adhesions have been formed between the sac and protruded intestine, or the portion of peritoneum which has descended, and is forming part of the sac, may have brought with it a portion of the intestine, to which it is naturally closely connected, as the cœcum, and which thus becomes irreducible: in either case the reduction of the hernia is of course prevented.

Mode of ope-
rating.

Instead of performing the same operation, as in other cases, I should, under these circumstances, merely expose the upper part of the hernial sac, and divide the stricture without opening the peritoneum, unless the stricture happened to be seated in the mouth of the sac itself.

Case.

The first time that I had an opportunity of performing the operation in this manner, was upon a patient of Mr. Birch's, in St. Thomas's Hospital. The man was between fifty and sixty years of age, and had been subject to a hernia from his infancy, which, becoming strangulated, and not yielding to the usual measures, rendered an operation necessary. From the size of the hernia, which reached half way to the knees, and its duration, I conceived that such adhesions might have occurred as would render its reduction impossible, and that the ordinary mode of operating would be extremely hazardous, on account of exposing so large a surface of intestine; I therefore determined upon trying what could be effected by a division of the stricture, without opening the hernial sac.

Operation.

I commenced by making an incision, beginning about one inch and a half above the external abdominal ring, and terminating about the same distance below it; this exposed the tendon of the external oblique, and the fascia of the cord. I then carefully made an opening into the latter, large enough to admit a director, which I introduced, and upon it divided the fascia so as to expose the cremaster muscle as far as the external ring; after this I passed

the director between the cremaster and edge of the external ring, and introducing a probed bistoury, I cut through a part of the tendon of the external oblique, so as to enlarge the external ring. On passing my finger into the inguinal canal, to the edge of the transversalis muscle, I felt some further resistance, and again introducing the director, I carefully separated some fibres of this muscle. The contents of the hernial sac were then reduced, and the edges of the wound being approximated, the patient was put to bed.

The wound healed kindly in about three weeks, although the hernia was protruded upon the slightest exertion, which would have occasioned much irritation, had the sac been opened. The patient was subsequently obliged to wear a laced bag truss.

Should the stricture be seated in the neck of the hernial sac itself, of course the division of the parts exterior to it will not relieve the strangulation; in this case the sac must be opened carefully at the upper part only, so as to allow of a division of the stricture.

Division of the stricture.

Having divided the stricture, the surgeon must avoid violence in attempting to return the protruded parts, for the reasons I have before mentioned. I have known the intestine ruptured in forcibly endeavouring to effect the reduction after the liberation of the stricture. The case occurred in St. Thomas's Hospital, and terminated fatally. The ruptured intestine is preserved in the collection at that hospital.

Care in returning the viscera.

Some surgeons object to the division of the stricture without opening the hernial sac, urging that the intestine or omentum may be in a gangrenous state, and that this cannot be ascertained unless the sac be opened; but I should imagine that a very limited experience would enable the surgeon to form an accurate opinion in this respect.

The oblique hernia is sometimes confined entirely to the in- Appearance.

guinal canal, and does not emerge through the external ring. It is often difficult to detect in the living subject, as there is no distinct tumour perceptible, but merely a fulness above Poupart's ligament. When strangulated, the usual symptoms are present, and the part is very tender on pressure, or during coughing.

Coverings.

This hernia is covered by the superficial fascia, the tendon of the external oblique muscle, by a thin fascia from the edge of the internal ring, and in part by the cremaster muscle, the spermatic cord and the epigastric artery lie posterior to it.

Mistaken:

These herniæ, when strangulated, are often mistaken for cases of peritoneal inflammation, as the patient is not conscious of having a swelling; and thus he may fall a victim to the disease, without a suspicion of its true nature.

Case.

A patient was admitted into St. Thomas's Hospital with a hernia of this description, strangulated, which was treated as peritoneal inflammation, for five days before the true nature of the complaint was discovered. There was a fulness above Poupart's ligament, which was painful on pressure or during coughing; and on pressing the part, a small tumour appeared at the external ring, which disappeared when the part above was not pressed.

The operation was performed, and a portion of the circumference of one of the small intestines was found strangulated, but not gangrenous. Although the strangulation had existed for so long a period, and the patient had suffered from hiccough, and extreme tenderness of his abdomen, yet he ultimately recovered.

Mode of operating.

The mode of operating in these cases is as follows:—The hair having been removed from the part, and the patient being placed in a convenient position, an oblique incision is to be made, commencing at the upper part of the swelling, about midway between the anterior superior spinous process of the ilium and symphysis pubis, and terminating a little above the external abdominal ring. This incision should divide the integument and superficial fascia, and expose the tendon of the external oblique muscle, which is to be carefully cut through in the same direction, when the hernial sac will be seen covered by a very thin fascia, which is given off

from the upper aperture. Part of the cremaster muscle is also found covering the lower part of the sac. The sac is to be opened with the usual precautions, and the stricture, which will be found at the upper orifice, is to be carefully divided upwards, by first passing a small director under it, and then introducing the hernia knife upon the director.

The return of the hernial sac into the cavity of the abdomen has been recommended in this form of hernia; but it does not appear that any advantage is gained by it, independent, in many cases, of the difficulty of effecting it.

Hernial sac returned.

Mr. Weld, junior, surgeon, at Romford, having occasion to perform an operation upon a woman, on account of the strangulation of a hernia of this kind, after liberating the stricture, returned the sac into the abdomen. The woman recovered, but some time after became the subject of hernia at the same spot, as she would not wear a truss after the operation.

Case.

I am indebted to my friend Mr. Thomas Blizzard, for the following curious and interesting case of hernia, descending behind the spermatic cord, which had been accompanied with hydrocele, in the tunica vaginalis of the same side.

The patient had been the subject of hernia on the right side, for six years, for which he had worn a truss; and from his own account a hydrocele had formed on each side, two years previous to his coming under the care of Mr. Blizzard; but that on the right side had gradually disappeared, leaving the testis wasted and drawn up to the groin.

Case.

The hernia becoming strangulated, and not yielding to the usual means employed for reducing it, Mr. Blizzard performed the operation about twenty-four hours after the commencement of the symptoms. Having laid bare what he thought was the hernial sac, he punctured it, and then freely opened it upon the director. It extended through the external ring, into the inguinal canal, which Mr. Blizzard in part cut open, in order to make the necessary examination of what he conceived to be the hernial sac; this, how-

ever, proved to be the tunica vaginalis, which had formerly been distended by the hydrocele, having the hernia seated behind it. The posterior part of this tunic was then cut through, exposing the hernial sac, which was found to contain a portion of intestine nearly of a black colour, from strangulation. The stricture which was seated at the mouth of the sac was divided in the usual manner, and the intestine returned. The patient did well. Mr. Henry Cline had occasion to operate upon a similar case.

OF DIRECT INGUINAL HERNIA.

Sometimes a hernia protrudes nearer to the pubes than that I have just described, descending from the abdomen immediately behind the external abdominal ring, and having the epigastric artery situated on its outer side.

First observed
by Mr. Cline.

Mr. Cline first observed this species of hernia, in opening the body of a Chelsea pensioner, with Mr. Adair Hawkins, on the 6th of May, 1777. The hernia was on the right side, and the mouth of the hernial sac was situated an inch and a half on the inner side of the epigastric artery. I have myself witnessed several cases of this description.

Course of

I have carefully dissected this hernia, and found that it passed on the inner side of the epigastric artery, and protruded through the external abdominal ring, under the fascia of the cord, pushing the spermatic cord to the outer and upper part of the tumor. I traced a covering upon it, formed in part by the tendon of the transversalis muscle, and in part by the fascia transversalis; beneath which is situated the hernial sac. The coverings of this hernia are, therefore, the integument, the fascia of the cord, a part of the cremaster crossing obliquely the outer part of the swelling, then the fascia and tendon of the transversalis.

Hernia from the
oblique inguinal

It differs from the oblique inguinal hernia in not taking the course of the inguinal canal, but in protruding directly through the external ring, and having the epigastric artery to its outer side,



and in having but an imperfect covering from the cremaster, and a perfect one from the fascia transversalis and tendon of the transversalis united.

The distinguishing marks between the direct and oblique inguinal hernia, are the situation of the spermatic cord, and the direction of the tumour; in the first, the spermatic cord is on the outer and upper part of the swelling, and the swelling may be traced in a direction towards the umbilicus:—in the latter, the spermatic cord is situated behind the hernia, and the inclination of the tumour is towards the spine of the ilium. Distinguishing marks.

The direct inguinal hernia may be produced suddenly from a laceration of the tendon of the transversalis, in which case the covering from this tendon will be found wanting. Causes.

A gentleman applied to me, having a direct inguinal hernia, which had appeared immediately after he had been thrown from his horse, and had fallen with the lower part of the abdomen upon a post, by which accident I imagine the tendon of the transversalis might have been ruptured. Case.

I have never seen this hernia acquire the size of the common inguinal hernia, and in most of the cases I have witnessed, the patients have had some disease of the urethra. Seldom becomes large.

In a patient of Mr. Weston's, of Shoreditch, who had for a long time laboured under difficulty in passing his urine, I found six herniæ of this description, of which I have given a plate. I also found several strictures in his urethra, and a stone lodged behind one of them. Case in which six herniæ existed.

TREATMENT OF DIRECT INGUINAL HERNIA.

When reducible, the truss employed should be longer than that applied for common inguinal hernia, as the part at which the hernia quits the abdomen is an inch and a half nearer to the pubes. The pad of the truss should not rest on the pubes, but press principally a little above the abdominal ring, otherwise the general form of the truss may be the same. Truss.

ever, proved to be the tunica vaginalis, which had formerly been distended by the hydrocele, having the hernia seated behind it. The posterior part of this tunic was then cut through, exposing the hernial sac, which was found to contain a portion of intestine nearly of a black colour, from strangulation. The stricture which was seated at the mouth of the sac was divided in the usual manner, and the intestine returned. The patient did well. Mr. Henry Cline had occasion to operate upon a similar case.

OF DIRECT INGUINAL HERNIA.

Sometimes a hernia protrudes nearer to the pubes than that I have just described, descending from the abdomen immediately behind the external abdominal ring, and having the epigastric artery situated on its outer side.

First observed
by Mr. Cline.

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Differs from the
oblique hernia.

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Distinguishing marks.

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Case.

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Case in which six herniæ existed.

TREATMENT OF DIRECT INGUINAL HERNIA.

When reducible, the truss employed should be longer than that applied for common inguinal hernia, as the part at which the hernia quits the abdomen is an inch and a half nearer to the pubes. The pad of the truss should not rest on the pubes, but press principally a little above the abdominal ring, otherwise the general form of the truss may be the same.

Truss.

When irreducible.

If the hernia be irreducible, the means recommended for the oblique irreducible hernia will be proper.

When strangulated, taxis.

When strangulated, the reduction must be attempted in a different direction to that required for the oblique. The tumour is to be grasped as in the oblique hernia, with one hand, while the fingers and thumb of the other hand are to be placed over the abdominal ring, to knead the neck of the swelling, and the pressure must be directed upwards and inwards, instead of upwards and outwards.

Case.

In this manner I quickly succeeded in reducing a direct hernia which had become strangulated, in a patient who was admitted into Guy's Hospital, for some other complaints. The hernia was small, it had the cord to its outer side, and could not be traced higher than the abdominal ring.

Hernia apparently reduced.

This hernia may apparently be reduced by the employment of the taxis, and strangulation still exist; a case of this kind occurred a short time ago at Guy's Hospital. A man applied at the surgery, having a direct hernia strangulated, and the taxis was had recourse to, by which the gentleman in attendance thought he had succeeded in reducing the hernia, as he had pushed it through the abdominal ring. The symptoms of strangulation, however, still continued, and in two or three days the man died. On examination of his body, the hernia was found placed immediately behind the external ring, with a stricture still existing at the mouth of the sac.

Caution in operating.

If the operation for this variety of hernia be performed in the manner usually advised in bubonocoele, that is, by dilating the hernial sac and stricture upwards and outwards, the epigastric artery will certainly be divided. It has therefore been recommended to alter the direction of the incision, and to make it upwards and *inwards*, to avoid the epigastric artery; and, if the surgeon is certain as to the species of hernia, that is the safest plan. But if, in some instances, the operator is directed to make the incision in one way, and in others precisely the reverse, there will always be reason to fear some mistakes in practice, which would

be attended with the most serious consequences ; such mistakes, it is true, would hardly occur to a surgeon constantly in the habit of dissection, but to the greater number the distinguishing marks of the two species will not be sufficiently discriminative. It is therefore desirable to point out such a mode of operating as would ensure the safety of the patient, of whatever kind the hernia may be. Such are the advantages possessed by the method of making the division directly upwards, opposite to the middle of the hernial sac, for in this direction the epigastric artery is certainly avoided.

The operation, therefore, is to be performed in the following manner : the surgeon first makes an incision through the integuments, along the middle of the tumour, from its upper to its lower part, following the longitudinal direction of the tumour ; so that if it has any inclination inwards towards the umbilicus, the incision should incline the same way. The fascia being exposed, is divided over the surface of the tumour from the abdominal ring down to its lower extremity. The hernial sac which now comes in view, is then opened, from an inch below the ring down to the lower part of the sac, in the same cautious manner as has been formerly described. The surgeon then passes his finger into the sac, and feels for the stricture ; if at the abdominal ring, he introduces the blunt sharp pointed bistoury between the sac and the ring, slitting the latter directly upwards, till the aperture is large enough to allow of the return of the parts ; if the stricture is above the ring, he follows it with the knife still in the same direction, and anterior to it, opposite the middle of the mouth of the sac, till the dilatation is sufficient to allow his finger to slip into the cavity of the abdomen ; after which the hernia is to be pushed up, or, if not in a fit state for that purpose, to be treated as mentioned in a former chapter. The parts anterior to the sac above the ring, and divided by the knife, are the tendons of the transverse and internal oblique muscles. If the stricture is within the sac, still the same direction is to be preserved, but the knife must then be passed into the sac itself.

In this way the epigastric artery will, with certainty, be avoided ;

which it cannot be if the division of the stricture is made outwards, and in the common hernia it will be divided by dilating inwards.

Some, however, have doubted the possibility of the epigastric artery ever being divided, whatever may have been the direction of the incision; and in support of this opinion, they adduce the great number of operations which have been performed by various practitioners, without the occurrence of this accident. However, this artery may actually have been divided, and produced the patient's death, by pouring its contents into the cavity of the abdomen, without the surgeon being aware of the mischief which his knife has occasioned; and even when the accident has been known by him to have happened, the circumstance has been concealed from the public.

OF INGUINAL HERNIA IN THE FEMALE.

Structure of
parts.

The structure of the inguinal canal in the female is very much the same as that which I have described in the male, only that the round ligament in the former takes the place of the spermatic cord existing in the latter.

Round liga-
ment.

The round ligament, which commences at the fundus uteri, passes from the abdomen midway between the anterior superior spinous process of the ilium to the outer side of the epigastric artery, above Poupart's ligament, and below the transversalis and internal oblique muscles, as the spermatic cord in the male; it takes a course obliquely downwards, and inwards to the external abdominal ring, through which it passes, and is lost upon the pubes.

This round ligament, however, being much smaller than the spermatic cord of the male, passes through openings corresponding to its size, which are consequently much less than those for the spermatic cord, and on this account the formation of inguinal hernia in the female is of comparatively rare occurrence.

Course of the
hernia

When this hernia does occur in the female, it takes the course

of the round ligament, is at first confined to the inguinal canal, where it is covered by the tendon of the external oblique, and subsequently it protrudes through the external ring, and forms a swelling at the upper part of the labium, which seldom acquires a large size ; here it is covered by a superficial fascia given off from the tendon of the external oblique.

It is produced by the same causes in the female as in the male, **Causes.** and presents the same symptoms. The sac usually contains either intestine or omentum, or both, but sometimes the appendages of the uterus are found in it.

As the round ligament in the female is not liable to the same affections as the spermatic cord of the male, the hernia in the former case is not likely to be confounded as it frequently is in the latter case with such diseases. I have, however, known this form of hernia in the female mistaken for a femoral hernia, which may readily be imagined when we recollect the proximity of the parts concerned. **Less liable to mistake than in the male.**

A careful examination will readily enable the surgeon to distinguish between the two, as in the inguinal the neck of the tumour is above Poupart's ligament, and in the femoral below ; in the former, also, the spinous process of the pubes can be readily felt outside the swelling, which it cannot be in the latter. **How distinguished from femoral.**

When this hernia can be reduced, a truss, similar to that necessary for a male, is to be employed. **Reducible.**

When irreducible, the same treatment as recommended for the male will be proper. If intestinal and small, a truss with a hollow pad ; if omental, a common pad ; and when the hernia is very large, a T bandage, to give support and prevent increase. **Irreducible.**

Should this hernia become strangulated, the taxis should be first employed in the same way as in the other sex ; and should this not succeed, bleeding, the warm bath, ice, the tobacco enema, or other means to assist reduction, should be had recourse to. **Strangulated.**

The usual means having failed to relieve the strangulation, an operation becomes necessary, which should be performed in the following manner.

Operation.

The hair having been removed from the surface of the tumour, and the patient being placed in the same position that I directed the male should be under similar circumstances, the surgeon should make an incision through the integument, commencing a little above the external abdominal ring, and terminating at the lower part of the swelling. This exposes the fascia covering the hernial sac, which should next be carefully divided to the extent of the first incision. The sac, being thus laid bare, should first be cautiously punctured as before mentioned, and then should be further opened upon the director.

The portion of the hernial sac below the external abdominal ring may perhaps contain only a quantity of the dark serum usually found; in which case the operator must introduce his finger into that part of the sac which is in the inguinal canal, and there he will feel the portion of intestine or omentum which is strangulated. He should then slit up the canal and sac towards the anterior superior spinous process of the ilium, so as to expose the strangulated parts; and, ascertaining the seat of stricture, he should pass a small director under it, and carrying the hernia knife upon the director, the stricture should be divided upwards, or upwards and outwards, after which the protruded parts are to be returned, if they be not in a state of gangrene.

The last case of inguinal hernia in the female, in which I had an opportunity of witnessing the operation, was under the care of Mr. Forster, in Guy's Hospital.

Case.

Upon opening the sac below the external ring, a quantity of fluid escaped, but there was not any appearance of intestine or omentum. However, upon passing the finger into the sac, through the external ring, a portion of intestine could be distinctly felt, which Mr. Forster subsequently exposed, by slitting up the inguinal canal. The stricture, which was seated at the internal ring, was divided upon a director in the usual manner, and the patient did extremely well.

After-treatment.

The after-treatment does not differ from that I have directed for the other sex.

When the inguinal hernia in the female has not descended through the external ring, it may become strangulated, and occasion fatal consequences, as in the male, without its existence having been recognised during the life of the patient. In the inguinal canal.

A patient was admitted into St. Thomas's Hospital, under the care of Sir Gilbert Blane, with symptoms of strangulated hernia; but upon being closely questioned by Sir Gilbert, she denied the existence of any tumour at the groin, navel, or elsewhere, and the case was consequently treated as one of inflammation. The woman died; and Sir Gilbert, supposing that some concealed hernia might have been the cause of her death, inspected the body, and found a small strangulated inguinal hernia on the right side, which did not protrude an inch from the internal ring. Case.

When necessary, the operation in this case is similar to that required for the same disease in the male. Operation.

I have never seen direct inguinal hernia in the female.

OF CONGENITAL HERNIA.

In this hernia the protruded parts have not any proper peritoneal sac, as the common inguinal hernia, but are contained in the tunica vaginalis of the testicle. All herniæ seated in this cavity are not, however, congenital, as such protrusion may occur at the adult period for the first time. No proper sac.

This hernia is originating from the descent of the testicle in the foetus. Usually about the seventh month, the testicles, which are up to that period seated upon the loins, begin to descend into the scrotum. At this time, a strong ligament is found connected with the inferior part of the testis and epididimis, and passing to the scrotum in the same direction as the spermatic cord is afterwards placed; it is called the gubernaculum, and appears to guide the testicle into the situation provided for it. Origin.

The testicle and its vessels are covered by peritoneum, except just where the latter enter at the posterior part of the former.

In its descent, the testicle takes with it a portion of peritoneum, Descent of the testicle.

which afterwards becomes the tunica vaginalis; and it is usually found in the scrotum at the ninth month; but there is considerable variety as to the period when the descent is complete, sometimes being earlier or later than the ninth month, sometimes one testicle comes down first, and the other does not descend until some time afterwards. In some cases, the testicles never quit the abdomen, and in others they only descend to the groin.

When the testicle has reached the scrotum, the opening through which it quitted the abdomen generally closes, but at what period is not precisely ascertained. If, however, it should remain open at the time of birth, the efforts of the child in breathing or crying cause the protrusion of a small portion of intestine into the cavity, and thus the congenital hernia is formed.

Called the windy
rupture.

From its appearance and feel, more particularly when the child cries, the nurses call it the windy rupture, in opposition to the term watery rupture, which they apply to an hydrocele, when it occurs in the infant, and this is not very unfrequent.

Sometimes oc-
curs at the adult
period.

I have found the tunica vaginalis sufficiently open at the adult period to admit the introduction of a female catheter; and I have known hernia, similar to the true congenital form, occur in persons between twenty and thirty years of age. In these cases I imagine the opening at first to have been so small as not to admit the descent of a hernia under ordinary circumstances, but that when the patients have been under the necessity of doing very laborious work, or during a state of great relaxation, the protrusion has taken place.

Course.

The congenital hernia must necessarily take the course of the spermatic cord, passing in the same direction as an oblique inguinal hernia, from which it is to be distinguished by the following marks. In common oblique inguinal hernia, the testicle is perfectly distinct from the hernial sac; whereas, in the congenital disease, the testicle is confounded with the sac. In the latter case, also, the appearance of the part very much resembles that of a hydrocele; more especially if, as sometimes happens, a quantity of fluid descends into the sac with the intestine or omentum, which,

upon a close inspection, gives a transparent appearance to the swelling. To distinguish these joint diseases, the contents of the hernia should be returned into the cavity of the abdomen whilst the patient is in a recumbent posture; after this, a moderate pressure is to be made against the abdominal ring, with the finger, so as to prevent the descent of the intestine or omentum; if the patient then assume the erect position, the water will escape into the tunica vaginalis, but the intestine or omentum will be felt pressing against the finger above.

Sometimes the testicle does not descend to the bottom of the scrotum, and then, if a congenital hernia form, the tunica vaginalis becomes elongated, and reaches considerably below the situation of the testicle.

In the congenital form of hernia, also, the cord is occasionally divided, the artery and vein being on one side, and the vas deferens taking its course on the other side. Division of the cord.

When the congenital hernia is reducible, it requires the use of a truss, as the common inguinal hernia, provided that the testicle has completely descended into the scrotum, or does not rest at the groin. For the first three months, perhaps a pad and bandage may be sufficient to prevent the descent of the hernia; but after this period a truss with a spring may be employed with safety, or even at a younger period if necessary. Reducible.

If the testicle be seated in the groin, a truss cannot be worn without risk of injuring the gland, and it is better to allow of such a protrusion as will assist the complete descent of the testicle, before any truss or other means of suppressing the hernia be resorted to. Testicle in the groin.

A young man who now holds a situation of importance, and who is the father of several children, was brought to me formerly by his father, on account of his having a congenital hernia; but because the descent of the testicle on the same side was incomplete, I directed that the protrusion should not be retarded. The testicle afterwards descended into the scrotum, a truss was then applied for the hernia, and the disease was ultimately subdued. Case.

Closure of the tunic.

After the truss has been worn for some time, the tunica vaginalis becomes closed at the upper part, and near the testicle, but sometimes remains open between, allowing a space for the deposit of fluid which occasionally takes place, forming hydrocele of the cord, and for the cure of which I have had to perform an operation on several occasions.

Irreducible.

With regard to the treatment of this hernia in the irreducible state, the same as directed for common inguinal hernia, is here applicable; and when strangulated, the same means as recommended in the latter case, should be employed for the relief of the patient.

Operation.

When an operation is required, it should differ from that described as necessary for common oblique inguinal hernia, in the following particular. Having laid bare the tunica vaginalis, it should not be opened low down on account of exposing the testicle, but a sufficient quantity of the tunic should be left whole to cover this gland.

Large quantity of fluid.

On opening the tunica vaginalis, a much larger quantity of fluid generally escapes than is found in the sac of a common inguinal hernia.

Seat of stricture.

The seat of stricture will be generally found under the edge of the transversalis muscle, or at the internal ring, when it should be divided in the same manner as in other cases of hernia; after which, the protruded parts, if not adherent, should be returned. If extensively adherent, the stricture should be divided in the same way, but the surgeon should not attempt to separate the adhesions, unless very few and slight, in order to allow of the return of the parts; but they should be left; and after the wound has healed, a bag truss will be required, as for other irreducible scrotal herniæ.

In operating for this form of hernia, the testicle is sometimes found in the inguinal canal in contact with the intestine; in which case the intestine only should be returned into the abdomen, the testicle being left in the canal. The stricture in this case is at the orifice of the tunica vaginalis.

PLATE VI.

Fig 1



Fig 2



Fig 3.



Fig 4

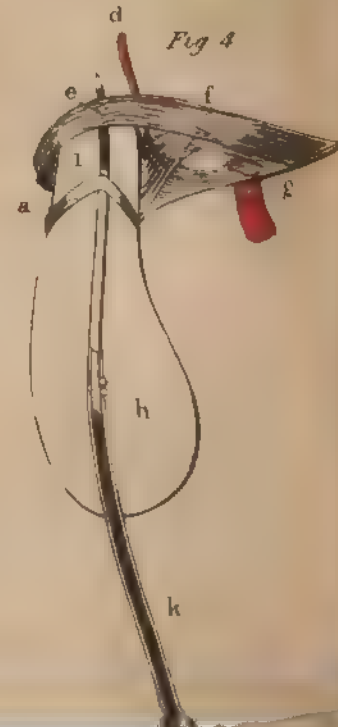


PLATE VI.

Different views of preparations of inguinal herniæ, intended to shew the mode of operating on each variety.

Fig. 1. *a a a*, Tunica vaginalis.

b, Testis.

c, Spermatic cord.

d, Hernial sac within the tunica vaginalis.

e, Mouth of the sac, which has been produced by an adhesion of the tunica vaginalis, opposite the abdominal ring.

f f, Intestine.

Fig. 2. *a*, Strangulated intestine, the sac cut open.

b, The adhesions of the tunica vaginalis to the mouth of the sac.

Fig. 3. Common inguinal hernia.

a, Abdominal ring.

b, Poupart's ligament.

c, Femoral artery.

d, Epigastric artery.

e, Hernial sac below the ring.

f, Hernial sac above the ring.

g, The sharp part of the knife introduced between the ring and the sac, with its side towards the sac; its edge is to be turned forward to divide the ring.

Fig. 4. Hernia on the inner side of the epigastric artery.

a, Abdominal ring.

b, Poupart's ligament.

c, Femoral artery.

d, Epigastric artery.

e, Internal oblique and transverse muscles passing over the sac.

f, Tendon of the transversalis muscle passing under it.

g, Fascia from Poupart's ligament, the cord being removed to shew the opening by which it passes.

PLATE VI., CONTINUED.

h, Hernial sac above the ring.

k, Knife introduced indicating the manner of dilating the stricture, that is forwards and upwards, opposite to the middle of the mouth of the hernial sac, in all the varieties of inguinal hernia, excepting when the spermatic cord is on the anterior part of the mouth of the sac, then the division should be made outwards.

OF ENCYSTED HERNIA OF THE TUNICA VAGINALIS.

This is a particular species of hernia, which occurs in the following manner. The tunica vaginalis becomes closed, by adhesion, opposite the abdominal ring, but remains open above and below it; and when a protrusion of intestine occurs, this adherent portion of the tunic becomes elongated, forming a distinct hernial sac within the proper tunica vaginalis. How formed.

I had an opportunity of witnessing the following case, under the care of Mr. Forster, in Guy's Hospital. A man was admitted into the house with symptoms of strangulated hernia, which the usual means failed to relieve, and the operation was proposed and urged; but the patient would not submit, choosing rather to die. On examining his body after death, a sac was found within the tunica vaginalis, descending from the abdominal ring towards the testicle. This sac contained a portion of one of the small intestines which had become gangrenous. The stricture was at the mouth of the sac. Case.

In operating upon a case of this kind, the tunica vaginalis should be opened freely, to expose the sac, otherwise some difficulty may arise. Operation.

Mr. Hey, in his surgical observations, has related a case similar to that of Mr. Forster.

 LECTURE XLV.

ON CRURAL HERNIA.

WHEN a femoral hernia commences, the patient's attention is first directed to the part on account of experiencing pain on suddenly straightening the limb, as in rising from a sitting posture. Commencement of the hernia.

This is occasioned by the extension of the fascia lata, and its pressing on the protruded parts.

Appearance of the hernia.

On examining the seat of pain, a fulness is discovered at the upper and inner part of the femoral sheath, which disappears on pressure, or when the patient is recumbent. This fulness soon increases, so as to form a tumour about the size of a small walnut, which is situated immediately below Poupart's ligament, to the inner side of the femoral vessels, and to the outside of the spine of the pubes. As the swelling enlarges, it projects more forwards and upwards, turning over Poupart's ligament, as it meets with the least resistance in this direction.

Like an enlarged gland.

When the tumour is small, from its situation and circumscribed feel, it has much the character of an enlarged inguinal gland.

Direction of the hernia.

The direction of this hernia is at first a little downwards in the femoral sheath, then obliquely inwards and forwards, and lastly upwards; sometimes, however, instead of turning up over Poupart's ligament, it takes a course downwards, in the direction of the saphena major vein; but this very rarely happens.

Dissection of the hernia.

On dissecting a femoral hernia, the following appearances present themselves. On cutting through the integument, the fascia superficialis is exposed; this, in its natural state, is thin and delicate; but frequently, when hernia exists, the fascia becomes dense and tough from pressure. Under this fascia a portion of the sheath of the femoral vessels is found, which closely envelopes the hernial sac itself; it is that portion which is perforated for the entrance of absorbent vessels.

Fascia propria.

This covering I first became acquainted with in examining a patient in St. Thomas's Hospital, in the year 1800, and have since invariably found it when operating for this form of hernia. It may be termed the fascia propria of the hernia.

Beneath this covering, and between it and the sac itself, there is generally some adipose matter situated, on separating which the sac is laid bare. This layer of adipose matter I have known to be mistaken for omentum.

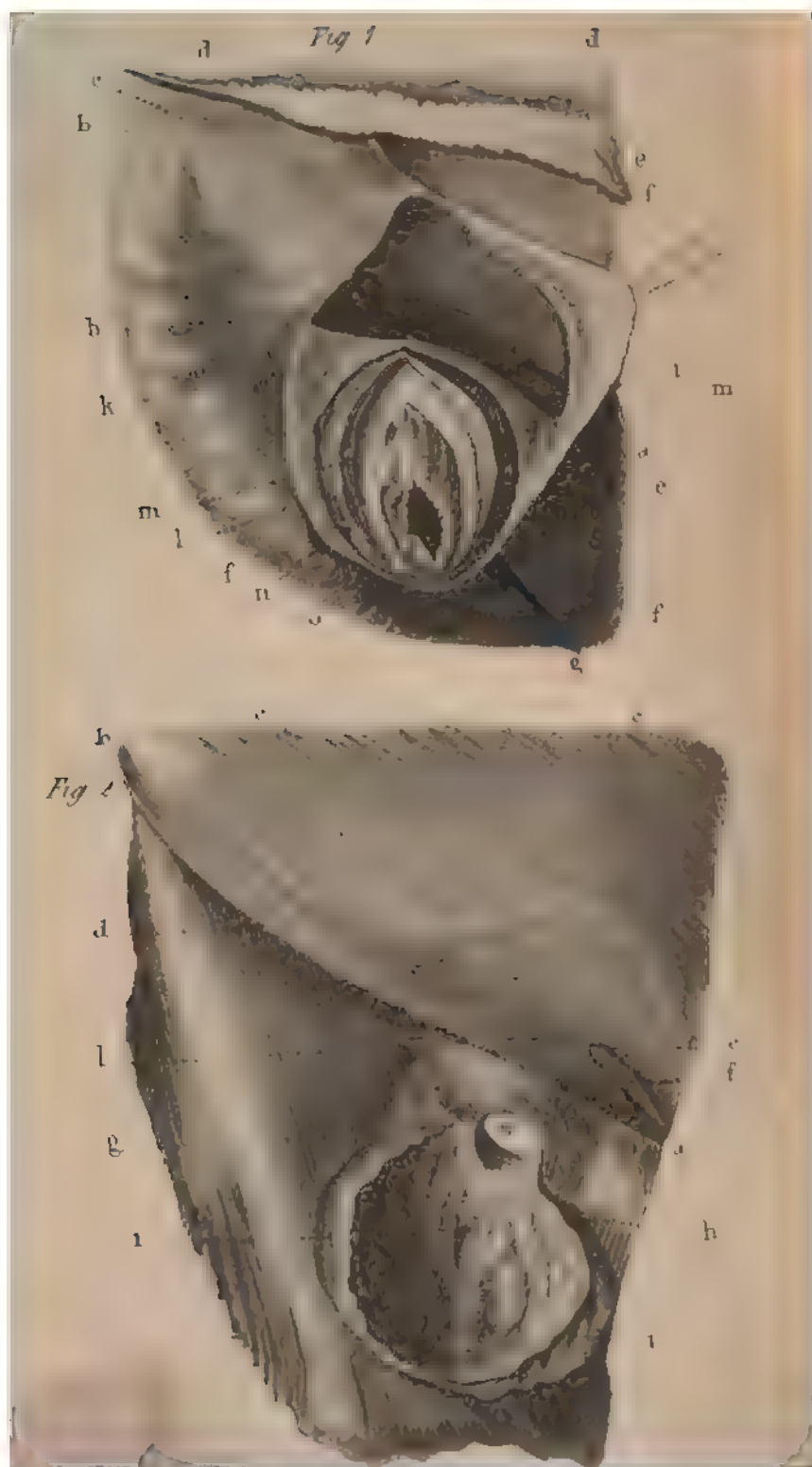


PLATE VII.

Different views of crural hernia in the female.

Fig. 1. First dissection of crural hernia.

- a*, Symphysis pubis.
- b*, Spinous process of the ilium.
- c*, Situation of the crural arch, or Poupart's ligament.
- d d*, Tendon of the external oblique muscle.
- e*, Superficial fascia raised from the external oblique muscle.
- f f f*, Superficial fascia.
- g*, Saphena major vein, the superficial fascia being cut away to shew it.
- h*, A part of the superficial fascia attached to the crural arch.
- i*, Abdominal ring and round ligament passing through it.
- k*, Superficial fascia raised from the hernia.
- l l*, Fascia propria raised from the hernial sac.
- m m*, Hernial sac.
- n*, Omentum within the sac.
- o*, Intestine within the sac.

Fig. 2. Shews the origin and appearance of the fascia propria.

- a*, Seat of symphysis pubis.
- b*, Spinous process of the ilium.
- c c*, Abdominal muscles.
- d*, Crural arch.
- e*, Abdominal ring.
- f*, Ligamentum rotundum uteri.
- g*, Fascia lata.
- h*, Portion of the fascia lata over the pectineus muscle.
- i i*, Fascia propria, or protruded crural sheath, which covered the hernial sac.
- k*, Attachment of the fascia propria to the sheath of the femoral vessels.
- l*, A portion of the sheath covering the crural vessels, exposed by removing the semilunar edge of the fascia lata.

THE TV. OBSERVATION

6. The purpose of the present study was to determine how
different types of work affect the health of the worker.
The aim of the present study was to determine the effect of the
different types of work on the health of the worker.

The form of the sac in crural hernia differs from that of the inguinal; the shape of the latter is pyriform, but the fundus of the crural bears a very large proportion to its orifice, and the form of the sac, when inflated and dried, is generally that of the following outline.

The orifice of the sac is surrounded by a fascia or cellular membrane, much condensed by an adhesive process which forms with the fascia below a complete bag, out of which the hernia may be drawn and the bag left behind perfect. Between the orifice of the hernial sac and the tuberosity of the pubes is situated the insertion of the external oblique muscle into the linea ileo pectinea, and ligament of the pubes. Behind it, is the os pubis, covered by its ligament and fascia iliaca; anterior to it, is the beginning of the posterior edge of the crural arch; and below this, the lunated edge of the fascia lata, and part of the crural sheath; and on its outer side is a thin process of fascia, which passes between it and the iliac vein. Indeed, it is according to the size of the hernia that there is more or less remaining of the original fascia, which extends from the insertion of the external oblique to the iliac vein. If the hernia is small, a process of this fascia remains round the orifice of the sac; but if it is large, the orifice occupies the whole space between the insertion of the external oblique and the crural vein, excepting that a thin portion of fascia still remains between the vein and the sac. This vein runs on the outer side of the hernial sac, about half an inch from the centre of its orifice, and half an inch beyond the vein; and exterior to it is the centre of the external iliac artery; the epigastric artery arises from the external iliac, about three quarters of an inch from the centre of the sac, and as it passes forwards and upwards, it approaches this point about a quarter of an inch nearer. The general distances of the different parts are as follows.

MALE.

From the symphysis pubis to the centre of the orifice of the sac, two inches.

From the centre of the orifice of the sac to the external iliac artery, one inch.

From the centre of the orifice of the sac to the centre of the external iliac vein, half an inch.

From the centre of the orifice of the sac to the origin of the epigastric artery, three-fourths of an inch.

From the centre of the orifice of the sac to the inner edge of the internal abdominal ring, one inch.

From the tuberosity of the pubes to the centre of the orifice of the crural hernia, one inch.

FEMALE.

Each measurement is from one-eighth to one-fourth of an inch more, where the female pubis is large and well formed, than in the male.

The spermatic cord of the male, and the round ligament of the uterus in the female, pass about half an inch anterior to the mouth of the hernial sac, being first situated to the outer side, and afterwards crossing its fore part.

When the opening through which the hernial sac has passed is examined anteriorly, it will be found that the sac, after descending a little way into the crural sheath, turns inward and protrudes the inner part of this sheath where the absorbent vessels pass. The hernial sac is here placed between two columns of fascia of the crural ring sheath; the one proceeds from the anterior part of the insertion of the external oblique muscle into the pubes, is reflected behind the crural vein, and passes over the neck of the sac: the other arises from the point of insertion of the external oblique into the linea ileo-pectinea and ligament of the pubes, is continued behind the neck of the sac, and is at last undistinguishably blended both with the fascia that covers the crural vein, and with that part of the fascia which passes over the pectineus muscle.

The same general symptoms characterize crural as inguinal hernia; it appears in the erect, and disappears in the recumbent

posture ; it dilates when the patient coughs, is elastic and uniform to the touch when it contains intestine, and gives a gurgling noise when it returns into the abdomen. When it contains omentum, the surface is less equal, it feels doughy, and gives no particular sound when it returns into the abdominal cavity.

The femoral hernia is much less likely to be confounded with other diseases than the inguinal, on account of the much more frequent formation of various tumours in the situation of the latter ; but still there are some diseases which I have known to be mistaken for femoral hernia, and in the discrimination of which much care is requisite.

Mistaken for
other diseases.

In several instances, an enlarged gland in the groin has been mistaken for a femoral hernia ; and, on the contrary, the hernia has been treated as an enlarged and suppurating gland ; but such mistakes must arise from inattention to the previous history of the case.

Enlarged gland.

Some years ago, a man was admitted into Guy's Hospital with a strangulated hernia, over which a poultice had been applied for three days before his admission, under the supposition that it was a bubo. The operation was performed, and the intestine found gangrenous.

Case.

Mr. Bethune, surgeon, at Westerham, in Kent, assured me, that he saw a patient who had been the subject of a strangulated femoral hernia, which had been poulticed for some days, and at length opened, when air and feculent matter escaped, and the patient died ten days after.

Case.

When a femoral hernia and enlarged gland exist at the same time, an attentive and minute examination is sometimes requisite to ascertain the existence of the former.

Hernia and
enlarged gland.

I once saw a lady with Mr. Owen, surgeon to the Universal Dispensary, who had suffered from symptoms of strangulated hernia for nine days, and had been treated for inflammation of the intestines, as she had not mentioned the existence of a swelling in her groin. Mr. Owen discovered this swelling, and in consequence requested me to visit the patient, at the same time inform-

Case.

ing me, that the tumour had not the feel of a hernia, but that he supposed it must be one from the symptoms. Upon examining the part, I found an enlarged gland, about the size of a walnut, very hard, and movable; but beneath this gland, and separate from it, was an elastic tumour, which I succeeded in reducing by the employment of the taxis; and this relieved the patient from all the symptoms of strangulation.

Psoas abscess.

Some of the symptoms attending psoas abscess resemble those of a femoral hernia, and might lead to mistake. Psoas abscess makes its appearance in the groin, in the same situation as a femoral hernia; it dilates when the patient coughs, and is less apparent when the person is in a recumbent posture than when he is erect. It may, however, be readily distinguished from hernia by the pain in the loins which precedes the appearance of the swelling, by the general constitutional derangement attending it, by its more rapid increase, and by the absence of intestinal derangement.

Inguinal hernia.

The error of most consequence respecting femoral hernia, is, that of mistaking it for inguinal hernia. Danger arises under such circumstances, from the operation of the taxis, the direction to make pressure in the femoral being quite different from that proper in the inguinal; but the most serious mischief is likely to arise, if an operation be necessary, in the division of the stricture.

Case.

I was once sent for to operate on a patient for a strangulated inguinal hernia, which, on examination, I found to be femoral, and succeeded in reducing it, by making the pressure in the proper direction; and I have known operations performed as for inguinal hernia, when the disease has been femoral. These mistakes arise from the femoral protrusion turning up over the crural arch or Poupart's ligament; and much attention is often requisite in making an examination, before the surgeon can confidently decide on the true nature of the disease. The best marks of distinction which I have observed, are, that the neck of the femoral hernia is below and to the outer side of the spine of the pubes, while that

of the inguinal hernia is above the spine ; also, by drawing down a femoral hernia, Poupart's ligament may be traced above it, which it cannot be if the disease be inguinal.

I have seen a case of enlargement of the femoral vein, which had somewhat the appearance of a femoral hernia, but it was readily detected, by pressing on the iliac vein above, while the patient was recumbent, when the tumour immediately appeared. Varicose vein.

Femoral hernia is most frequent upon the right side, probably on account of most persons employing that side in the greatest degree. This hernia most frequent on the right side.

Women who have borne many children are more liable to this disease than others, which arises from the extension of the abdominal parietes during gestation, causing a more relaxed state of the parts ; also, old persons are more frequently troubled with this disease than the young. Mothers liable to it.

Most frequently the protruded part in femoral hernia is small intestine, very rarely only omentum, but occasionally both intestine and omentum. I have seen the cœcum in a femoral hernia on the right side, and the ovaria have also been found in the hernial sac. Most frequently intestinal.

The femoral hernia is produced by the same causes as occasion the formation of inguinal hernia, except that I do not recollect a single instance in which this disease has been originated by a blow. Causes.

EXPLANATION OF PLATE X.

Fig. 1. First dissection of crural hernia.

- a.* Symphysis pubis.
- b.* Spinous process of the ilium.
- c.* Situation of the crural arch, or Poupart's ligament.
- d d.* Tendon of the external oblique muscle.
- e.* Superficial fascia raised from the external oblique muscle.

- fff.* Superficial fascia.
- g.* Saphena major vein, the superficial fascia being cut away to shew it.
- h.* A part of the superficial fascia attached to the crural arch.
- i.* Abdominal ring and round ligament passing through it.
- k.* Superficial fascia raised from the hernia.
- ll.* Fascia propria raised from the hernial sac.
- mm.* Hernial sac.
- n.* Omentum within the sac.
- o.* Intestine within the sac.

Fig. 2. Shews the origin and appearance of the fascia propria.

- a.* Seat of symphysis pubis.
- b.* Spinous process of the ilium.
- cc.* Abdominal muscles.
- d.* Crural arch.
- e.* Abdominal ring.
- f.* Ligamentum rotundum uteri.
- g.* Fascia lata.
- h.* Portion of the fascia lata over the pectineus muscle.
- ii.* Fascia propria, or protruded crural sheath, which covered the hernial sac.
- k.* Attachment of the fascia propria to the sheath of the femoral vessels.
- l.* A portion of the sheath covering the crural vessels, exposed by removing the semilunar edge of the fascia lata.
- m.* The opening in the sheath, through which the hernia had descended, above which is seen a dotted line, which marks the seat of the anterior stricture, and which is the part generally required to be divided.

Fig. 3. A small crural hernia dissected.

- a.* Seat of symphysis pubis.
- b.* Spinous process of the ilium.
- c.* Tendon of the external oblique muscle.

- d.* Anterior edge of the crural arch.
- e.* Abdominal ring.
- f.* Superficial fascia turned from the external oblique muscle.
- g.* Superficial fascia upon the fascia lata.
- h.* Crural vein.
- i.* Absorbent gland thrust down by the hernia.
- k.* Superficial fascia opened where it covered the hernia.
- l.* Fascia propria of the hernial sac.
- m.* Hernial sac unopened.

Fig. 4. A small hernia in the male, to shew the origin of the fascia propria.

- a.* Seat of symphysis pubis.
- b.* A portion of the crural arch.
- c.* Insertion of the external oblique into the pubes.
- d.* Portion of the fascia transversalis descending to unite itself to the crural vein.
- e.* Portion of the crural vein.
- f.* Edge of the fascia lata, cut from Poupart's ligament, and drawn downwards to expose the parts behind.
- g.* Fascia lata wrinkled by its falling down.
- h.* Semilunar edge of the fascia lata.
- i.* Saphena major vein passing into the crural sheath.
- k.* The portion of the crural sheath which covered the crural hernia, and forming the fascia propria, the hernial sac having been entirely removed.
- l.* The aperture by which the crural hernia had descended from the abdomen.
- m.* A depression within the crural sheath, in which a process of the hernial sac was contained.

EXPLANATION OF PLATE XI.

This plate exhibits two different views of crural hernia in the male.—Fig. 1 is preserved in the collection at Guy's Hospital. Fig. 2 is in my own possession.

- Fig. 1.**
- a.* Symphysis pubis.
 - b.* Spinous process of the ilium.
 - c c.* Abdominal muscles.
 - d.* The crural arch, or Poupart's ligament.
 - e.* Semilunar edge of the fascia lata.
 - f.* Tendon of external oblique cut open.
 - g.* Internal oblique and transversalis.
 - h.* External portion of the fascia transversalis.
 - i.* Internal portion of the same fascia.
 - k.* Internal abdominal ring.
 - l.* External abdominal ring.
 - m m m.* Spermatic cord passing through both apertures to t
testis.
 - n.* Testis.
 - o.* Epigastric artery.
 - p.* Cremaster muscle.
 - q.* Crural hernia.
 - r.* The sac of the crural hernia.
 - s.* The fascia propria, which covers the hernial sac.
- Fig. 2.** Anterior view of another crural hernia.
- a.* Symphysis pubis.
 - b.* Spinous process of the ilium.
 - c.* Abdominal muscles.
 - d.* Crural arch, or Poupart's ligament.
 - e.* Abdominal ring.
 - f.* Spermatic cord.
 - g.* Testis.
 - h.* Crural hernia.
 - i i.* Superficial fascia cut open and turned back.
 - k k.* Fascia propria of the sac laid open.
 - l l.* Hernial sac laid open.
 - m.* Omentum seen within the sac.

TREATMENT OF THE REDUCIBLE FEMORAL HERNIA.

From the small size of the opening through which femoral hernia passes, the patient is in great danger from strangulation, unless proper means be adopted to prevent the descent of the viscera. Danger of strangulation.

The employment of a truss is the only method by which the safety of a patient can be secured; but the truss required for femoral hernia must be of somewhat different construction to that which is required in inguinal hernia. Truss.

The pad, instead of being continued nearly in a straight direction with respect to the spring, as when required for inguinal hernia, should project downwards, nearly at right angles, to the spring, that it may effectually press upon the opening through which the hernia protrudes under Poupart's ligament, and also upon the upper part of the thigh.

The truss should be constantly worn, as for inguinal hernia, to prevent the protrusion of the hernia, and also with the view of obliterating the mouth of the sac, and curing the disease. To be constantly worn.

It is very rare, however, that a cure is effected in femoral hernia by means of the truss, but still it is right that it should be constantly kept on. I have known many instances in which the constant application of the truss has not produced the smallest apparent alteration in this hernia; the reason is, because Poupart's ligament, and the fascia lata, support the pressure of the truss, and the constant variation in the tension of these parts on every movement of the body, prevents the steady pressure necessary to produce a gradual closure of the opening. Does not cure.

In some cases, when the opening of the femoral sheath is large, it will be necessary to have a larger pad and a stronger spring to the truss, and the pad may be more effectually kept in place, by means of a strap passed from it round the upper part of the thigh.

Double truss.

If a hernia exist on both sides, a double truss will be required, made upon the same principles as the single one.

Salmon and Ody's truss.

The truss made by Salmon and Ody I have generally found best adapted to these cases.

EXPLANATION OF PLATE XII.

Fig. 1. Anterior view of a crural and two inguinal herniæ.

- a.* Symphysis pubis.
- b.* Spinous process of the ilium.
- c c.* Crural arch sending off the fascia lata of the thigh.
- d d.* Semilunar edge of the fascia lata.
- e e.* Saphena major vein on each side.
- f f.* Abdominal rings.
- g.* Sac of the inguinal hernia on the left side.
- h.* Its fascial covering.
- i.* Inguinal hernia on the right, its cavity obliterated by adhesion.
- k.* Sac of crural hernia.
- m.* Its orifice, which had been dilated inwards in the operation for this hernia.

Fig. 2. *a.* Inguinal truss.

b. Crural truss.

Fig. 3. *d.* Truss for the large crural hernia.

- e.* Upper abdominal ring.
- f.* The place at which the crural hernia descends.
- g.* Lower abdominal opening or ring.

OF THE IRREDUCIBLE FEMORAL HERNIA.**Causes.**

Femoral hernia may become irreducible from adhesions of the protruded parts to the interior of the hernial sac; from a growth

PLATE VIII., CONTINUED.

- n*, Testis.**
- o*, Epigastric artery.**
- p*, Cremaster muscle.**
- q*, Crural hernia.**
- r*, The sac of the crural hernia.**
- s*, The fascia propria, which covers the hernial sac.**

Fig. 3. A small crural hernia dissected.

- a*, Symphysis pubis.**
- b*, Spinous process of the ilium.**
- c*, Tendon of the external oblique.**
- d*, Anterior edge of the crural arch.**
- e*, Abdominal ring.**
- f*, Superficial fascia turned from the external oblique muscle.**
- g*, Superficial fascia upon the fascia lata.**
- h*, Crural vein.**
- i*, Absorbent gland thrust down by the hernia.**
- k*, Superficial fascia opened where it covered the hernia.**
- l*, Fascia propria of the hernial sac.**
- m*, Hernial sac unopened.**

of the protruded parts within the sac, so that they cannot repass the opening into the abdomen, or by a contraction at the neck of the sac itself, producing the same consequences.

In either case, a truss should be applied with a hollow pad, which is to receive the tumour, and prevent its increase. **Treatment.**

A gentleman consulted me, in consequence of his having an irreducible femoral hernia, which, upon examination, I thought only to contain omentum; I directed him to wear a truss, with a depression in the pad, just large enough to receive the tumour. Two or three years afterwards, I saw this gentleman again, when I was gratified in learning, that his hernia had nearly disappeared. This was in consequence of absorption of the omentum having been produced by the pressure of the pad. **Case.**

If the hernia be entirely intestinal, this form of truss, with a hollow pad, cannot always be borne, as I have known it to create very severe suffering. **Truss cannot always be worn.**

OF STRANGULATED FEMORAL HERNIA.

The symptoms of strangulation being the same as those I have already detailed in the lecture on inguinal hernia, I shall not again repeat them, but merely observe, that in femoral hernia, they are usually more urgent on account of the smallness of the opening, through which the protrusion occurs, causing greater pressure. **Symptoms.**

The patients generally complain of more pain from strangulated femoral than inguinal hernia in the same state, and they die sooner from the former than the latter disease. **Severe.**

The medical treatment required for strangulated femoral hernia, does not differ materially from that necessary for the inguinal disease. **Medical treatment.**

In the first place, the taxis should be employed, but in a different mode to that I have described as proper for the reduction of inguinal hernia. The patient should be placed on a bed, with the shoulders elevated, and the thighs bent at right angles with the body, leaving only sufficient space between them to admit the arm **Taxis.**

Plate VIII.



Fig. 2

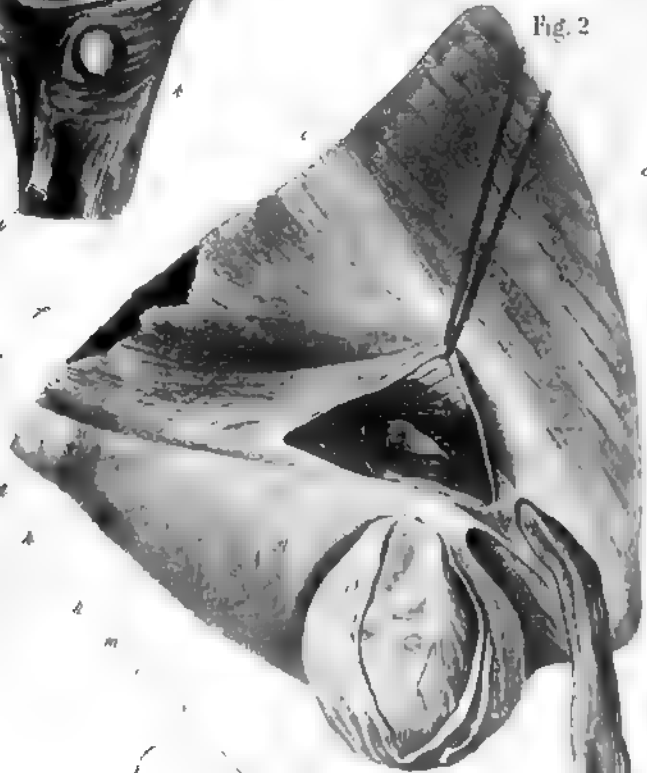


fig 3

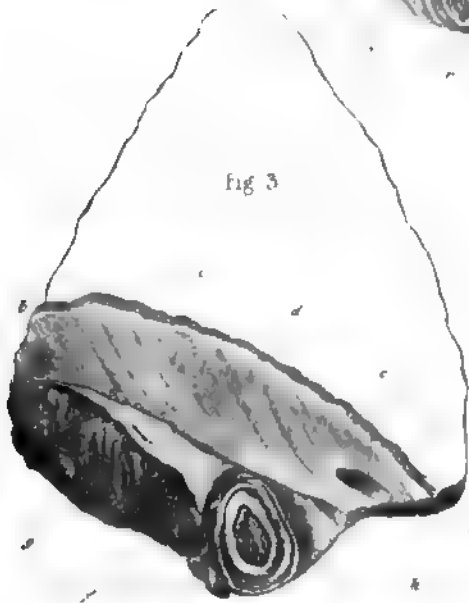


PLATE VIII.

Fig. 1. A small hernia in the male, to shew the origin of the fascia propria.

a, Seat of symphysis pubis.

b, A portion of the crural arch.

c, Insertion of the external oblique into the pubes.

d, Portion of the fascia transversalis descending to unite itself to the crural vein.

e, Portion of the crural vein.

f f, Edge of the fascia lata, cut from Poupart's ligament, and drawn downwards to expose the parts behind.

g, Fascia lata wrinkled by its falling down.

h, Semilunar edge of the fascia lata.

i, Saphena major vein passing into the crural sheath.

k, The portion of the crural sheath which covered the crural hernia, and forming the fascia propria, the hernial sac having been entirely removed.

l l, The aperture by which the crural hernia had descended from the abdomen.

m, A depression within the crural sheath, in which a process of the hernial sac was contained.

Fig. 2. Crural hernia in the male.

a, Symphysis pubis.

b, Spinous process of the ilium.

c c, Abdominal muscles.

d, The crural arch, or Poupart's ligament.

e, Semilunar edge of the fascia lata.

f, Tendon of external oblique cut open.

g, Internal oblique and transversalis.

h, External portion of the fascia transversalis.

i, Internal portion of the same fascia.

k, Internal abdominal ring.

l, External abdominal ring.

m m m, Spermatic cord passing through both apertures to the testis.

of the operator. The tumour is first to be pressed downwards, until it be below the level of Poupart's ligament, when it is to be kneaded upwards towards the abdomen.

Difficulty.

The difficulty usually experienced in attempting to reduce this form of hernia, arises from the pressure being made at first in an improper direction, viz. upwards, so that the hernia is forced over Poupart's ligament, instead of beneath it, and in this way the hernia never can be reduced.

As in the reduction of inguinal hernia, the pressure should be gentle and continued, avoiding violence, which may be productive of the most serious consequences.

General treatment.

Should the taxis fail, the same general treatment as that directed for inguinal hernia, should be pursued, as bleeding, the warm bath, opium, the application of cold, and the injection of the tobacco glyster. These remedies, however, have much less beneficial influence in femoral, than in the other forms of hernia; which I imagine is owing to the nature of the parts through which the protrusion occurs, and the smallness of the aperture through which it descends.

Symptoms urgent.

As the symptoms are usually very urgent in femoral hernia, and as the disease more rapidly destroys life, there is the greater necessity for the early performance of an operation, when the usual means to effect reduction have been tried and have failed. I have known a patient die in seventeen hours after the symptoms of strangulation had commenced; and on the contrary, I have performed an operation with success, after the symptoms had existed seven days; but in general, the patients labouring under this disease do not survive the strangulation more than four days, if the stricture remain; whereas, in inguinal hernia, under similar circumstances, they often live a week or more.

OF THE OPERATION FOR FEMORAL HERNIA.**Preparation.**

The hair is to be removed from the surface of the tumour, and the bladder should be emptied. The patient should then be placed

upon a table of convenient height, in a horizontal position, but his shoulders should be a little raised, and the thigh bent towards the abdomen, in order to relax the abdominal muscles, &c.

The first incision should commence a little above the superior part of the tumour, towards the umbilicus, and be extended downwards, somewhat to the inner side of the prominent part of the swelling, as far as its middle; a second incision should then be made from the inner to the outer side of the tumour, at right angles with the first incision, and joining it at the lower part, so that the two together form a figure resembling an inverted J. Operation.

The angular flaps should then be dissected up, to allow of sufficient space for the other steps of the operation.

The superficial fascia which is thus exposed, should next be divided to the same extent as the integument, by which the covering formed of the sheath of the femoral vessels will come into view*; this should be carefully cut into, so as to admit of the introduction of a director under it, upon which it should be further opened, so as to freely expose the hernial sac. Superficial fascia.

If the patient is fat, a layer of adipose matter may be found between this covering, formed of the sheath of the femoral vessels, and the sac itself. Layer of fat.

I have known this covering, which I call the fascia propria, to be mistaken for the hernial sac, so that the surgeon who operated, supposed he had opened the peritoneal covering when he cut into the sheath, and after considerable difficulty, he succeeded in pushing up the protruded parts, but on the following day the patient died; and when examining his body, it was discovered, that the hernial sac had not been opened, but had been thrust up into the abdomen with its contents, which still remained in a strangulated state. Sheath of the vessels.

The surgeon having exposed the hernial sac, should pinch up a small portion of its anterior and lower part, between his finger and Hernial sac.

* There is usually a considerable vein between the superficial fascia, and the fascia propria, as well as absorbent glands.

thumb, carefully excluding any portion of the contents of the sac, and then placing the blade of his knife horizontally, he should cautiously make a small cut into the elevated part, making an aperture of sufficient size to allow of the passage of a director, upon which he should further divide the anterior part of the sac upwards and downwards.

Fluid.

A quantity of fluid usually escapes, when the sac is first opened, which varies greatly in quantity, and somewhat in colour, according to the period that the strangulation has existed. It is not uncommon, however, for the fluid to be entirely wanting, even when there are no adhesions.

If inflammation runs high, the peritoneal surface of the intestine is covered by adhesive matter.

Division of the stricture.

The next and most important step in the operation, consists in dividing the stricture, the situation of which should first be distinctly ascertained by passing the point of the little finger into the hernial sac, on the fore and inner part of its contents.

Seat of.

If the hernia be large, the seat of stricture may be at or under the opening in the fascia lata, through which the covering formed by the sheath of the femoral vessels is protruded; but generally, the stricture will be found immediately beneath Poupart's ligament, in the mouth of the sac itself, where the hernia quits the abdomen.

In either case, a director should be very carefully introduced into the sac, anterior to its contents, and gradually insinuated under the stricture, and upon its groove the hernia knife (before described) should be passed, with its cutting edge turned upwards, and a little inwards, towards the umbilicus, in which direction the stricture should be divided.

Two strictures.

In some cases, when the hernia is large, strictures may be found both at the crescentic margin of the fascia lata, and under the crural arch of Poupart's ligament, and each will require division; that at the fascia lata must of course be first liberated.

How treated.

When a stricture, therefore, exists at the crescentic margin, the surgeon, after dividing it, should make a careful examination, to

ascertain if the passage to the abdomen be free, before he attempts to return the protruded parts, for should a second stricture exist, he may rupture the protruded intestine in the violence he must employ in endeavouring to return it.

In dividing the inner stricture, it has been recommended to cut in the direction of Gimbernat's ligament, inwards towards the pubes; but as the stricture is not occasioned by this ligament, there cannot be any necessity for dividing it; I have known Gimbernat's ligament divided, from an idea that it formed the stricture, but the stricture still remained at the orifice of the fascia propria, or in the mouth of the sac itself, and the patient died *.

Direction of division.

Great caution is requisite in dividing the stricture, if the protrusion be entirely intestinal, and the operator should not introduce the knife, until the intestine has been carefully placed out of danger by an assistant.

Great caution necessary.

Sometime ago, a case occurred in one of the Borough hospitals, in which the intestine was wounded, when the operator was dividing the stricture, which he did inwards, towards Gimbernat's ligament; feculent matter was extravasated into the cavity of the abdomen, and the patient died. On examining the parts after death, two openings were found in the intestine, close to the mouth of the sac.

Case.

The treatment I have directed as proper in inguinal hernia, when the protruded parts adhere to the sac, or when the intestine or omentum are gangrenous, is also proper under similar circumstances in femoral hernia.

Adhesions.

After the operation, the same mode of closing the wound, and

After-treatment.

* It is curious, that Gimbernat's ligament should ever have been supposed to be the seat of stricture, as it exists only upon the inner side of the mouth of the hernial sac, and therefore could not influence the outer portion. If strangulated femoral hernia be examined in the dead body, and Gimbernat's ligament be cut through, the hernia is not liberated by such a division, for the orifice of the fascia propria, or the neck of the sac itself, still girt the viscera as much as ever.

indeed the after-treatment generally, should be the same as in the inguinal disease.

But little variety.

Very little variety is met with in femoral hernia, the most important one is that in which the obturator artery arises from the epigastric, and surrounds the neck of the sac.

Dr. Barclay's preparation.

Dr. Barclay, a celebrated teacher of anatomy at Edinburgh, was kind enough to send me a specimen of this variety, which was taken from a patient, whose previous history could not be ascertained.

Mr. Wardrop has also met with this variety.

Common course of the obturator.

Although the obturator artery frequently arises from the epigastric, it is very rarely found passing before the sac in femoral hernia, but usually takes a course to the outer side, and beneath the sac, as I have often witnessed when dissecting the parts of femoral herniæ. My mode of avoiding injury to the epigastric or obturator arteries, is to make a very slight division of the stricture with the knife; and then, by pressure of the finger or of a director, to enlarge the opening.

Fluid beneath the fascia propria.

In one instance I have met with a large quantity of fluid situated between the fascia propria and the hernial sac. The following is a short account of the case:—

Case.

Miss ———, æt. 20, had been the subject of a femoral hernia on the right side for three or four years, which had acquired about the size of a pullet's egg. In June, 1825, the hernia became strangulated, and increased to a very large size. As she did not mention the existence of the hernia to her medical attendants, it was not discovered until the third day from the commencement of the symptoms, the continuance and severity of which led to an examination. Mr. Wakefield, of Hatton Garden, who had attended her, immediately requested me to visit her; when, after trying, without effect, the ordinary means to reduce the hernia, I operated. On opening the fascia propria, I was astonished at the escape of nearly a pint of transparent fluid, resembling that usually drawn off in hydrocele. The hernial sac, which then became

Fig. 3.

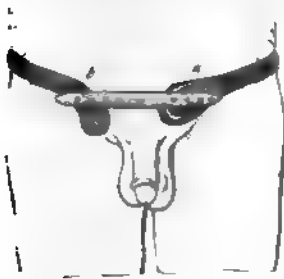


Fig. 4.

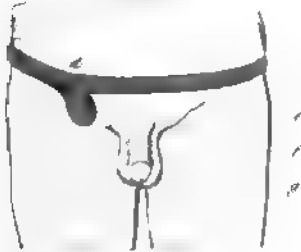


Fig. 1

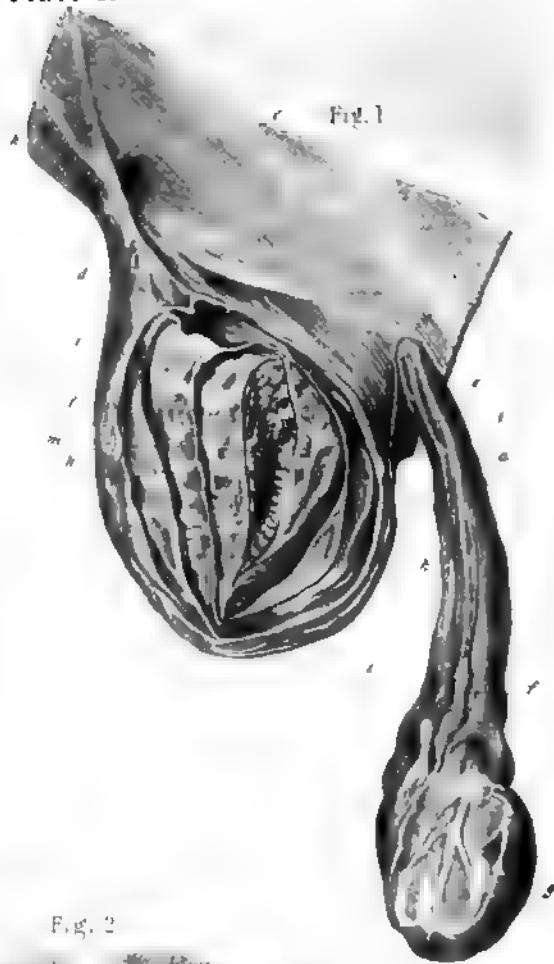


Fig. 2

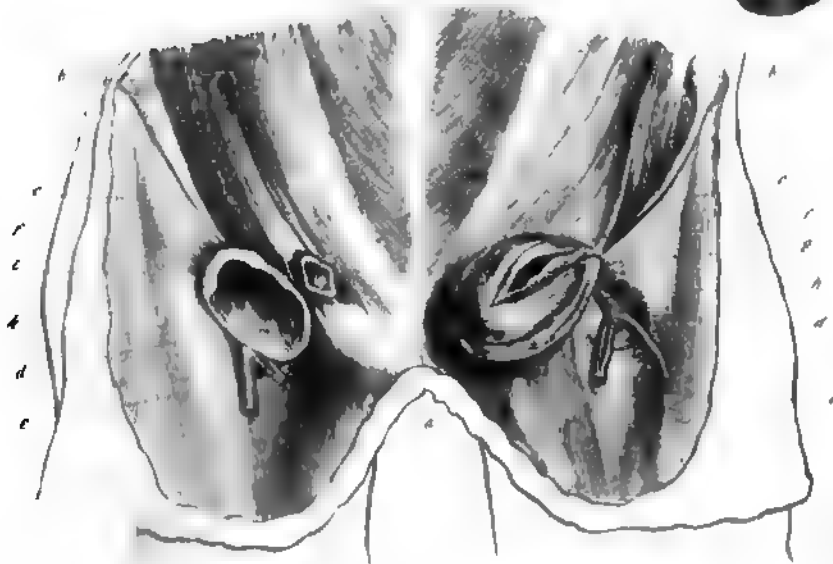


PLATE IX.

Fig. 1. Anterior view of another crural hernia.

- a*, Symphysis pubis.
- b*, Spinous process of the ilium.
- c*, Abdominal muscles.
- d*, Crural arch, or Poupart's ligament.
- e*, Abdominal ring.
- f*, Spermatic cord.
- g*, Testis.
- h*, Crural hernia.
- i i*, Superficial fascia cut open and turned back.
- k k*, Fascia propria of the sac laid open.
- l l*, Hernial sac laid open.
- m*, Omentum seen within the sac.

Fig. 2. Anterior view of a crural and two inguinal herniæ.

- a*, Symphysis pubis.
- b*, Spinous process of the ilium.
- c c*, Crural arch sending off the fascia lata of the thigh.
- d d*, Semilunar edge of the fascia lata.
- e e*, Saphena major vein on each side.
- f f*, Abdominal rings.
- g*, Sac of the inguinal hernia on the left side.
- h*, Its fascial covering.
- i*, Inguinal hernia on the right, its cavity obliterated by adhesion.
- k*, Sac of crural hernia.
- m*, Its orifice, which had been dilated inwards in the operation for this hernia.

Fig. 2. *a*, Inguinal truss.

- b*, Crural truss.

Fig. 3. *d*, Truss for the large crural hernia.

- e*, Upper abdominal ring.

PLATE IX., CONTINUED.

f, The place at which the crural hernia descends.

g, Lower abdominal opening or ring.

Fig. 3. Inguinal and crural truss.

a, Inguinal pad.

b, Crural pad.

Fig. 4. Truss for large crural hernia.

d, A large pad.

e, Upper abdominal opening.

f, The part where crural hernia descends.

g, The lower abdominal opening or external ring.

exposed, was small; and, on opening it, a little of the usual dark-coloured fluid was discharged. A small portion of omentum, with a fold of small intestine, were protruded. After dividing the stricture, and returning the viscera into the cavity of the abdomen, I removed a large part of this loose bag exterior to the sac. The patient recovered rapidly.

EXPLANATION OF PLATE XIII.

Preparations of crural hernia after the operation.

Fig. 1. A view of a preparation in which the intestine was divided by cutting inwards.

- a.* Seat of symphysis pubis.
- b.* Crural arch.
- c.* Abdominal muscles.
- d.* Fascia lata.
- e.* Femoral artery.
- f.* Femoral vein.
- g.* Hole in one fold of the intestine.
- h.* Hole in the other fold.
- i.* Hernial sac.

Fig. 2. Preparations of the hernial sac which had been returned into the abdomen unopened.

- a.* Seat of symphysis pubis.
- b.* Seat of the spine of the ilium.
- c c.* Abdominal muscles.
- d.* Muscles of the thigh.
- e.* Muscles of the outer part of the thigh.
- f.* Crural arch.
- g.* Femoral artery.
- h.* Femoral vein.
- i.* Large hole at the crural arch, by which the hernia was pushed back.

- k.* Fascia propria of the sac, which was also pushed within the abdomen.
- l.* Hernial sac.
- m m.* Peritoneum.
- n.* Strangulated intestine.
- o.* Intestine above the strangulated part.
- p.* Stricture at the mouth of the sac remaining undivided.
- q.* Mesentery.

LECTURE XLVI.

ON UMBILICAL HERNIA.

- Synonyme.** THIS form of hernia, which is also termed *exomphalos*, is next in frequency to the inguinal.
- Natural opening.** The protrusion takes place through the opening in the *linea alba*, which is formed in the foetal state for the passage of the vessels of the umbilical cord.
- How closed usually.** After the funis has been tied, this opening usually becomes closed by dense cellular tissue, and the remains of the umbilical veins and arteries, but not by a tendinous structure. The integument over it is adherent, and generally drawn in, forming the navel.
- Dissection of the parts.** Behind the navel, when these parts are dissected, the peritoneum is found, which adheres more firmly at this part than any other of the *linea alba*; it is connected above to the remains of the umbilical vein, and below to the ligament of the bladder and remains of the umbilical arteries. There is not any perforation in the peritoneum behind the navel, as the vessels do not penetrate it, but pass between it and the abdominal parietes.
- Commencement of the disease.** Umbilical hernia commences in a small protrusion about the size of a nut, which can be easily reduced, but which again appears immediately the patient coughs or exerts himself. If neglected, it soon increases in bulk; and, as it augments, it gravi-

tates ; so that the larger part of the swelling is below the orifice of the sac, and in some instances it acquires so great a size as to reach to the upper part of the thighs.

This disease, if intestinal, and not supported, is attended with much danger, and creates a considerable degree of suffering. The patient frequently feels so much weakness and sensation of sinking, as to be incapable of making exertion. The bowels are very irregular in their actions, and the patient is much troubled with flatulence and nausea.

Creates much suffering.

Besides the frequent occurrence of these symptoms, the intestinal protrusion may be distinguished by its elasticity, its uniform feel, and by the passage of the air, &c., through the canal, producing a gurgling noise.

Symptoms of intestinal.

When the protrusion is entirely omental, the patient experiences but little uneasiness or irregularity of the bowels. The feel of the swelling is uneven and doughy, and is but little tender under considerable pressure.

When omentum.

Sometimes, if both intestine and omentum are contained in the hernial sac, they can be distinguished from each other by the above-mentioned marks. The omentum is in these cases usually above, and the intestine below. But, most frequently, the quantity of omentum protruded is much larger than that of the intestine, and the latter is covered by the former, so that it cannot be at first distinguished.

When both.

The umbilical hernia is very common in infants soon after birth. Intestine is then generally protruded, and the shape of the swelling somewhat resembles the distended finger of a glove in shape ; the hernia is easily reduced, unless the opening in the linea alba is very small.

Common in infants.

Children, subject to this disease, suffer from griping and a very irregular state of bowels, sometimes being constipated, at others being violently purged.

When this hernia occurs in the adult, if the patient be thin, the shape of the tumour is pyriform and defined ; but in fat persons, the hernia is sometimes scarcely perceptible on a superficial in-

Appearance in the adult.

Danger of the operation.

The danger in this operation is of wounding the intestine, as there is not any vessel of importance that can be injured.

OF VENTRAL HERNIA.

Like the umbilical.

This hernia only differs from the umbilical in its seat, which is usually at the linea alba, or linea semilunaris; but any visceral protrusion at the anterior, or lateral parts of the abdomen, except those already described, may be called ventral herniæ.

Symptoms.

The symptoms of this form of hernia are usually the same as those of the umbilical, excepting when the hernia is formed between the umbilicus and ensiform cartilage in the linea alba, and contains a portion of the stomach, when peculiar symptoms will arise.

Case.

I once saw a gentleman with a hernia in this situation, who suffered constantly from indigestion, flatulency, and a distressing sensation of sinking at the scrobiculus cordis. His hernia was, however, reducible, and the application of a truss relieved all his unpleasant symptoms.

Causes.

The following causes may give rise to this hernia:—

1. A natural deficiency of tendinous structure, which I have known to a very considerable extent, in the linea alba or linea semilunaris.

2. The apertures for the passage of blood-vessels being unusually large.

3. Injuries by which the continuity of the parietes is destroyed.

Coverings.

The coverings of ventral hernia are generally the same as those of the umbilical disease; viz., the integument, superficial fascia, and peritoneal sac; but, in some instances, I have found another covering connected with the edge of the opening in the tendon through which the hernia escapes.

When this hernia occurs in consequence of wound, the coverings must, of course, vary.

Fig 1

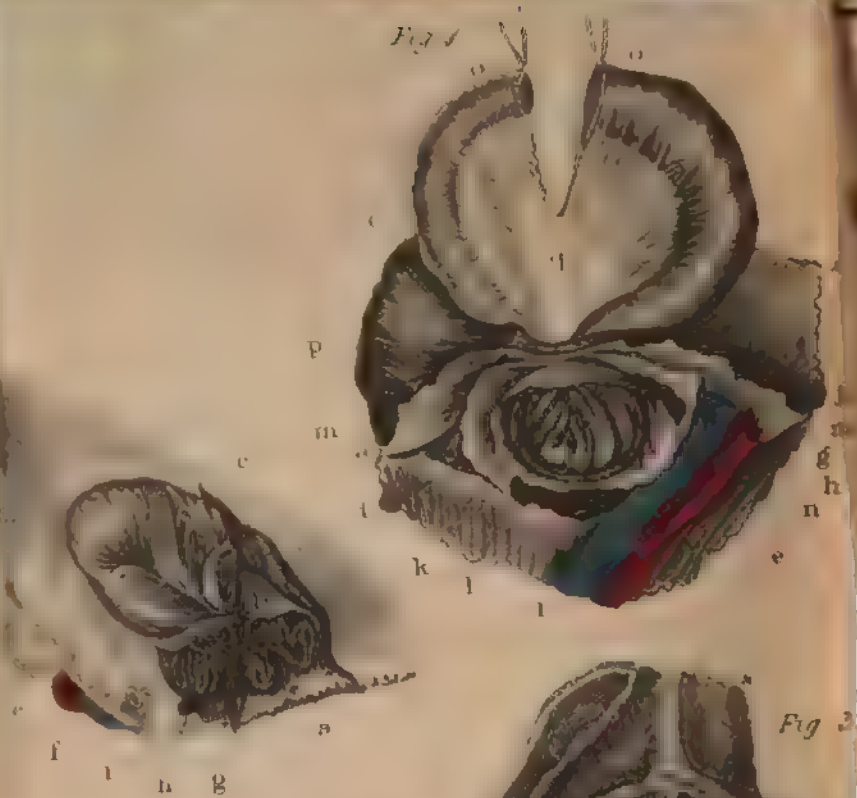


Fig 2

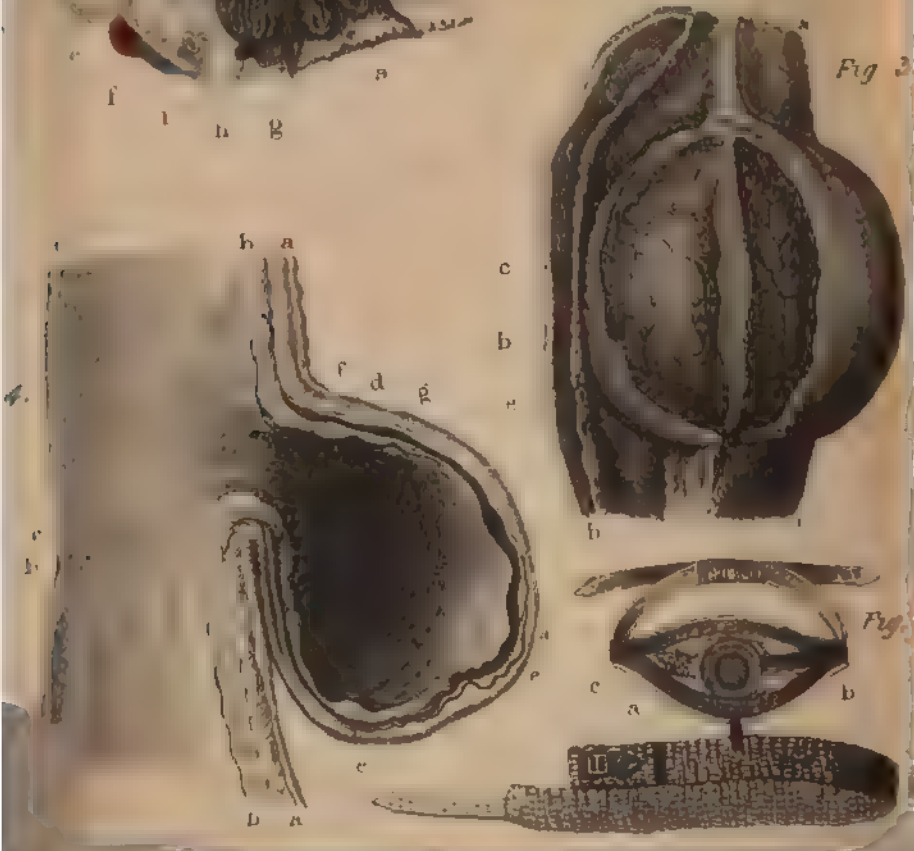


PLATE X.

Two views of crural hernia after the operation.

Fig. 1. Preparations of the hernial sac which had been returned into the abdomen unopened.

- a*, Seat of symphysis pubis.
- b*, Seat of the spine of the ilium.
- c c*, Abdominal muscles.
- d*, Muscles of the thigh.
- e*, Muscles of the outer part of the thigh.
- f*, Crural arch.
- g*, Femoral artery.
- h*, Femoral vein.
- i*, Large hole at the crural arch, by which the hernia was pushed back.
- k*, Fascia propria of the sac, which was also pushed within the abdomen.
- l*, Hernial sac.
- m m*, Peritoneum.
- n*, Strangulated intestine.
- o*, Intestine above the strangulated part.
- p*, Stricture at the mouth of the sac remaining undivided.
- q*, Mesentery.

Fig. 2. A view of a preparation in which the intestine was divided by cutting inwards.

- a*, Seat of Symphysis pubis.
- b*, Crural arch.
- c*, Abdominal muscles.
- d*, Fascia lata.
- e*, Femoral artery.
- f*, Femoral vein.
- g*, Hole in one fold of the intestine.
- h*, Hole in the other fold.
- i*, Hernial sac.

Fig. 3. Anterior view of ventral hernia.

- a a a*, The integuments.

PLATE X., CONTINUED.

b b, Tendon of the external oblique muscle and rectus behind it.

c, The hernia.

d, Fascia turned from the sac.

e, The hernial sac.

Fig. 4. The common appearance of umbilical hernia.

a a a, Integuments.

b b, Abdominal muscles.

c c c, Peritoneum.

d, Mouth of the hernial sac.

e, Hernial sac.

f f, Termination of the linea alba around the mouth of the sac.

g, Fascia lining the integuments and covering the sac.

In this preparation some omentum adhered within the sac, which was not included in the drawing.

Fig. 5. An improved truss by Mr. Morrison, of Leeds, for pregnant or corpulent females.

a, The pad.

b, The spring added to the pad.

c, An elastic band to assist the pressure of the pad.

The lower *b* points to the belt, which is added to keep this truss in its place in corpulent persons.

OF THE REDUCIBLE VENTRAL HERNIA.

When seated in the linea alba, a truss, similar to that employed **Truss.** for umbilical hernia, should be worn; but, when low down in the linea semilunaris, the truss applied should resemble that recommended for inguinal hernia, only that the pad must be turned somewhat upwards.

When irreducible, the same form of truss, with a hollow pad, will be required.

OF STRANGULATED VENTRAL HERNIA.

The symptoms indicating strangulation of this hernia are, in **Symptoms.** every respect, similar to those already described, as occurring when umbilical hernia is in the same state; and the means which should be tried, with a view of relieving the patient, should be of a like nature.

As in the umbilical disease, the tobacco enema has here a more **Treatment.** powerful effect than in the inguinal or femoral herniæ.

In employing the taxis, the pressure should be made a little **Taxis.** upwards as well as inwards, for the swelling, like the umbilical, has the greater part situated below the opening from the abdomen.

If an operation becomes necessary for the relief of the patient, **Operation.** it should be performed in the same mode as that described for umbilical hernia; but when the disease is seated low down in the linea semilunaris, the surgeon must bear in mind the course of the epigastric artery, and divide the stricture so as to avoid it.

In very large ventral herniæ, the operation I have mentioned **For large herniæ.** before, of merely exposing the neck of the sac, and dividing the stricture, without opening the sac itself, may be adapted with advantage.

In the after-treatment of these cases, nothing of importance is **After-treatment.** necessary beyond what I have already recommended for the other forms of herniæ.

OF THE THYROIDAL HERNIA, OR HERNIA FORAMINIS OVALIS.

The first example of this disease which I saw, was accidentally discovered in a male subject, in whom an inguinal hernia also existed on the same side. The parts are preserved in the collection at St. Thomas's Hospital.

Course.

The hernia was protruded through the opening in the ligament of the foramen ovale, by which the obturator artery and nerve pass to the thigh; the pubes was immediately before the neck of the sac, and the ligament of the foramen embraced the other portion about three-fourths. The obturator vessels were situated behind, and somewhat to the inner side of the neck of the sac. The sac itself, not larger than a nutmeg, was placed under the heads of the pectineus and adductor brevis muscles.

Two herniæ in the same person.

I lately had an opportunity of seeing two specimens of this hernia in the same subject, one existing on each side, which were not discovered during life.

Several cases of this form of hernia are related in the first volume of the Memoirs of the Royal Academy of Surgeons at Paris.

Operation difficult.

The depth at which this hernia is situated, would render an operation, in case of strangulation, extremely difficult; but, should such a step be necessary, I should recommend the division of the stricture inwards on account of the obturator artery, &c.

Treatment.

If reducible, a truss, similar to that used for crural hernia, but with a thicker pad, would prevent its further descent.

OF THE PUDENDAL HERNIA.

Its seat.

This hernia appears in the external labium pudendi, about its middle.

Course.

It commences at the side of the vagina, and passes into the labium between the vagina and ischium; it has usually a pyramidal figure, and presents the characters of other herniæ, as elasticity,

dilatation on coughing; also appearing in the erect position, and disappearing when the patient is recumbent.

The situation of the swelling, and its want of connection with the abdominal ring, sufficiently distinguish it from inguinal hernia, which also appears in the labium, but at the upper part.

The increase of this disease may be prevented by the patient's Treatment. constantly wearing a bandage to support the part; but a partial protrusion cannot readily be checked, as from its situation, a pessary, unless of very large size, would not be of any service.

When strangulated, the usual remedies before mentioned should be tried; and, if an operation becomes necessary, the sac should be carefully opened, and the stricture divided inwards towards the vagina, the bladder being previously emptied. When strangu-
lated.

OF THE VAGINAL HERNIA.

This hernia protrudes between the uterus and rectum, where the Its seat. peritoneum is reflected from one viscus to the other, at the posterior part of the vagina; sometimes, however, it appears at one side instead of the posterior part. It is only covered by the lining membrane of the vagina.

The use of a pessary will prevent the protrusion of this disease. Treatment.

OF THE PERINEAL HERNIA.

In the male, this hernia protrudes between the bladder and rec- Its seat. tum; and, in the female, between the rectum and vagina.

I have only seen one instance of this disease, which was in the Case. body of a male brought into the dissecting room.

The reflected portion of peritoneum between the bladder and Dissection. rectum, was protruded as far as the perineum, but no external tumour was perceptible; Mr. Cutcliffe, surgeon, at Barnstaple, has the parts preserved.

Anterior to the sac were seated part of the bladder, the prostrate gland and terminations of the vesiculæ seminales; behind was the

rectum, and the mouth of the sac was about two inches and a half from the anus.

The following curious case is taken from Mr. Bromfield's *Chirurgical Observations* :—

Case.

“ A lad, between six and seven years of age, was put under my care to be cut for the stone. The staff, in the attempt to introduce it into the bladder, met with resistance from a stone, which seemed to be lodged in the membranous part of the urethra, or a little lower down in the neck of the bladder. I made my incision, as usual, through the integument and muscles, to get at the groove of the staff; and then pressed the blade of my knife into the sulcus, at the extremity of the staff, being able to divide only the membranous part of the urethra; and a very small portion, if any, of the prostate gland; by the examination of the parts, with my fingers, I then found that this hard body was a process continued from the body of the stone contained in the bladder; I therefore took the double gorgeret, without the cutting blade affixed, intending only to push back the stone, and dilate the neck of the bladder, which I did by getting the beak of the gorgeret into the sulcus of the staff, and pressing it against the point of the stone, following its course with the instrument as the stone retired: but the direction that the gorgeret took alarmed me, as it passed under the ossa pubis with great obliquity. I then concluded that the instrument had taken a wrong route, as I could not, in this case, have the advantage of the groove of the staff farther than the extremity of the membranous part of the urethra; but, on withdrawing the upper part of the gorget, I introduced the fore-finger of my right hand into the bladder, by the under part of the instrument, which remained in the bladder, and was now no more than the common gorgeret; by which I was soon convinced that it was in the bladder, the situation of which was raised much higher in the pelvis than usual. I then introduced my forceps, and, while I was searching for the stone, a thin diaphanous vesicle, like an hydatid, appeared rather below my forceps, which, in the child's screaming, soon burst, discharged a clear water, as if forced from

a syringe; the next scream brought down a large quantity of small intestines. I need not say, that this was sufficient to embarrass a much better operator than myself; however, I proceeded in the operation with the greatest tranquillity, being convinced, that this very extraordinary event was not owing to any error in the operation: but the difficulty was to keep the intestine out of the cheeks of the forceps, when I should again attempt to lay hold of the stone; the extraction of which would be very difficult to effect, from the unusual situation of the bladder in this subject. The lower part of the gorgeret remaining in the bladder, the forceps were again easily introduced, which being done with the fingers of my right hand, I pressed back the intestines, while I laid hold of the stone; but during the extraction the intestines were again pushed out by the child's screaming; nevertheless, as I had the stone secure in my forceps, I proceeded to extract it, which I did very easily. Before I introduced the common gorget for the introduction of the forceps the next time, I got up the intestines again, and desired my assistant to keep them up till I got hold of a second stone, which, from its shape, appeared to be that which had got into the neck of the bladder. As soon as I was convinced by the examination, with my finger, that the bladder was freed totally from any pieces of stone, I again returned the intestines into the pelvis, and brought the child's thighs close together; a piece of dry lint was applied on the wound, and a pledget of digestive over it; he was then sent to bed, with no hope of his surviving till the next day; but, contrary to expectation, the child had a very good night, and was perfectly well in little more than a fortnight, without one alarming symptom during the process of cure; neither did the intestines once descend through the ruptured peritoneum after they had been returned when the operation was finished."

The following are Mr. Bromfield's ideas of the nature of this case :—

" After the incision of the integument and muscles was made, as usual, there soon appeared in the wound something like an hydatid, which proved afterwards to be that part of the peritoneum

which is extended from the left side of the bladder and intestinum rectum to its attachment on the inside of the left os innominatum; preventing the intestines from falling down too low into the pelvis; therefore, in this case, this expansion of the peritoneum must have been forced out of its usual situation.

“ Suffering daily more and more extension, it will at length permit the intestines to fall down to the very bottom of the pelvis, between the bladder and the rectum; therefore, when in the case above related, the resistance of the integument and muscles was taken off by the operation, the peritoneum was forced out, and at first was filled only with lymph, which gave it the appearance of an hydatid; but its thinness not being able to resist any longer the force of the abdominal muscles, pressing the viscera downwards, it burst, and the intestines soon followed through the aperture. If this is allowed, we can easily account for the oblique course that the gorgeret took when first introduced, as the intestines had raised up the fundus of the bladder against the back part of the ossa pubis, so that my forceps could not be conveyed into the bladder, but almost in a perpendicular direction; and I was obliged to press with my hand on the lower part of the abdomen, just above the pubes, to bring the bladder and its contents sufficiently low for the laying hold of the last stone with my forceps.”

Scarpa met with a case in which this hernia formed a tumour in the perineum.

This form of hernia, and the vaginal, may become dangerous during gestation, and some cases illustrating this are related in Dr. Smellie's cases on midwifery.

VESICAL HERNIA.

This variety of hernia is of very rare occurrence, for I have only seen two instances of it in the living subject. The symptoms characterising this species of hernia are the following. The size of the tumour varies, and is not much affected by the position of the body: but is most affected by the quantity of urine contained

in the bladder. This variation of size, however, is not always observable, as the bladder does not always discharge the whole of its contents when the patient makes water; that part of the viscus within the pelvis completely emptying itself, while the portion within the scrotum remains distended as before the attempt to void urine. Persons, therefore, labouring under this complaint, are sometimes under the necessity of raising the scrotum and pressing upon it, in order to force its contents into the pelvic portion of the bladder, by which means the whole volume of urine is discharged by the urethra. This imperfect evacuation of the bladder, to which these persons are liable, gives rise to another troublesome symptom, a very frequent desire to void the urine; for the part of the bladder within the scrotum, when imperfectly emptied, labours under a continued or frequently renewed sensation of distention, contracts upon its contents, impels the patient frequently to micturition, and thus gives rise to the symptoms of an irritable bladder. The fluctuating feel of the tumour in the scrotum might possibly lead to the suspicion of a common hydrocele, but in the cases which I have had an opportunity of examining, the tumour has not possessed transparency; this circumstance, together with the above symptoms, will sufficiently enable a surgeon to distinguish it from the latter disease.

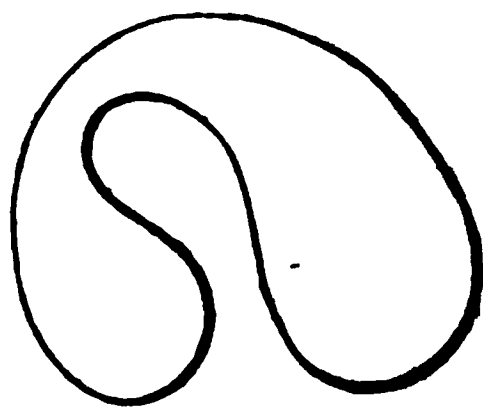
Two opportunities have presented themselves, which enabled me to examine the anatomy and appearances of this variety of hernia. For the first I am indebted to Mr. Maiden, of Stratford; and for the second to Mr. Hallam, at Walworth.

A large inguinal hernia was perceived on the right side, which had descended into the scrotum, so as to occupy its lower part. On removing the integuments, the fascia of the cord and the cremaster were seen spread over the part of the tumour, and both somewhat increased in density; these being removed, a hernial sac came into view; the cavity of this hernial sac was laid open by incision; both omentum and intestine presented themselves; the bag in which they were contained was complete, and the bladder

was still concealed. I then threw air in by the urethra, in order to inflate the bladder; and immediately the bladder began to swell, not only in the pelvis, but also in the scrotum behind the hernial sac, until it became as large nearly as an ostrich's egg. The bladder was situated behind the peritoneal sac, to the posterior part of which the anterior surface of the viscus closely adhered; posteriorly, it was connected by cellular membrane to the scrotum, and to the tunica vaginalis of the cord. On tracing it upwards, it was found to ascend through the external abdominal ring into the inguinal canal, where it maintained the same relative situation to the cremaster and spermatic vessels as in the scrotum; it thence descended through the internal abdominal ring into the pelvis. It is almost needless to observe, that both rings, especially the inner ring, were much dilated.

Its form, viewed anteriorly, resembled this outline.

This disease has its origin in a relaxed state of the bladder, and the protrusion is also probably favoured by neglect in regularly evacuating the bladder when required. The bladder thus becomes dis-



tended laterally, and spreads so as to occupy the lower part of the abdomen, and then reaches the inner abdominal aperture of the inguinal canal, through which it becomes forced by the weight and pressure of the superincumbent abdominal viscera, and the action of the abdominal muscles, diaphragm, and pyramidales. The following is the explanation of the peculiar peritoneal connexion which attends the vesical hernia. As the anterior and lateral parts of the bladder are in some degree devoid of peritoneal covering, the bladder at first enters the inguinal canal without bringing that membrane with it; but as soon as the fundus begins to descend, the peritoneum accompanies it; and with the sac thus formed, intestine and omentum afterwards produce the triple descent, of bladder behind the peritoneum, of intestine and omentum

into the peritoneum, which the fundus of the bladder causes to descend.

The treatment consists in the application of a truss, similar to that which is worn in the common inguinal hernia, and in paying unremitting attention to the frequent and complete discharge of urine. When the hernia is small, and the bladder only has descended, the cure is easier than in a common hernia, being assisted by the contraction of the muscular coat of the bladder. But if it has drawn down the peritoneum, intestine, and omentum with it, it will then be as difficult to cure as common inguinal hernia. The vesical hernia only admits of cure by a gradual absorption, or an extreme elongation of the adhesions which unite the bladder to the scrotum. I can hardly conceive the possibility of this hernia becoming strangulated, so as to really require an operation, unless a calculus has formed in the protruded part, and thus given rise to irritation, inflammation, and thickening of the parts.

A vesical hernia may also be a consequence of a previously formed femoral hernia of the common kind; for in a female of relaxed fibre I once saw the bladder drawn quite close to the orifice of a femoral hernial sac. But the comparatively small size of the aperture in femoral hernia, and the unyielding nature of the parts which form it, explain the reason of its not being met with in practice.

OF THE ISCHIATIC HERNIA.

This is an extremely rare form of hernia; indeed, I have only **Very rare.** seen one specimen of it, for which I am indebted to my friend Dr. Jones, whose name is well known by his excellent work on hæmorrhage.

Dr. Jones having told me that he had inspected the body of a **Case.** patient who had died in consequence of the strangulation of a

portion of intestine in the ischiatic notch, I became very anxious to obtain the parts; and, after considerable difficulty, we obtained permission to open the body a second time, when I removed the hernia and surrounding parts.

Dr. Jones had been requested to visit the patient, a young man about twenty-seven years of age, in consequence of his suffering from symptoms which resembled those produced by strangulated hernia. The patient stated that he had experienced a similar attack before, which had been relieved by opium, followed by a dose of castor oil. Dr. Jones, therefore, gave him some opium, and directed that he should take some pills composed of calomel and scammony, as soon as the stomach appeared tranquil.

On the day following, Dr. Jones found that the patient had experienced relief for a short period after taking the opium, but that the pills had been thrown up, and no evacuation had taken place from the bowels. The patient was also much troubled by eructations and flatulence, for which he took some spir. ammoniac comp. and spirit. lavendulæ, with good effect.

Dr. Jones, feeling confident that the symptoms were produced in consequence of the strangulation of some portion of the intestines, now examined the man carefully, but could not detect any protrusion; nor did the patient complain of any local pain which could induce Dr. Jones to inspect the ischiatic notch.

As no stools had been procured, some purgative glysters were thrown up, but without producing the desired effect. Other purgatives were subsequently given, and glysters were again thrown up, but without affording relief; also leeches and blisters were employed, but they produced only temporary benefit. On the sixth day from the commencement of these symptoms, they suddenly subsided, excepting that no evacuation from the bowels took place; and the patient felt himself so well, that he was desirous of going to business; but Dr. Jones advised him to remain quiet for some days. Early on the morning of the seventh day the patient got up, and went down from his bed-room, which was on the fourth

story, to the ground floor, but he soon returned, complaining of being very unwell; after which he gradually sunk, and expired on the same evening.

On examining the body after death, a portion of the ilium was discovered passing by the right side of the rectum to the ischiatic notch, through which a fold of the intestine was protruded into a small hernial sac, to the inner surface of which the intestine was adherent. The strangulated part of the gut, and about three inches of it on each side of the stricture, was very much discoloured. The intestines between the stomach and protruded portion were distended with air, and had a few livid spots upon them. The intestines from the stricture to the rectum were very much contracted, particularly the arch of the colon. Dissection.

On carefully dissecting the parts after I had removed them from the body, I found a small orifice in the pelvis, anterior to, but a little above the sciatic nerve, and on the fore part of the pyriformis muscle. This opening led to the hernial sac, which was situated under the gluteus maximus muscle, and in which the intestine had been strangulated.

The orifice of this hernial sac was placed anterior to the internal iliac artery and vein, below the obturator artery, and above the obturator vein; its neck was seated before the sciatic nerve, and its fundus was covered by the gluteus maximus muscle. Below the fundus was the sciatic nerve, and behind it the gluteal artery; above, it was placed near the bone.

Should the existence of such a hernia be ascertained, it might, if reducible, be prevented from protruding by the application of a spring truss; but should it become strangulated, and an operation be deemed advisable, I should recommend the division of the stricture to be made directly forwards. Treatment.

OF THE PHRENIC HERNIA.

Protrusions of the abdominal viscera through the diaphragm, Its seat.

may take place either at the natural apertures framed for the passage of the œsophagus, vena cava, aorta, &c., or through unnatural openings, the consequence of malformation or injury.

Symptoms. When this hernia exists, the patient suffers much from interrupted respiration and cough, besides experiencing the symptoms of hernia already enumerated.

Hernial sac. This hernia has, or has not a proper sac, according to the circumstances of its formation; when protruded through one of the natural apertures, it has a proper sac; when occurring from malformation, it sometimes has a peritoneal covering, and sometimes this covering is wanting; when the consequence of laceration or injury, the hernial sac is always deficient.

Case. I have never seen an hernia protruding through any of the natural openings of the diaphragm; but several cases are related by Morgagni, in which this form of hernia existed. He mentions the case of a young man who was attacked with symptoms of acute cardialgia and constant vomiting, under which he expired. On examining his body after death, the omentum, with part of the colon, the duodenum, some portion of the jejunum and ilium were found in the cavity of the thorax, having passed through the same opening by which the œsophagus descends; the lungs and the heart were compressed into a very small space.

From malformation. The occurrence of phrenic hernia from malformation is not very uncommon. There are two preparations in the Museum at St. Thomas's Hospital exhibiting this disease. In one instance the opening is of sufficient size to admit nearly the whole of the small intestines through it; in the other specimen the large portion of the stomach was protruded through a much smaller aperture. In both cases the unnatural openings are in the left muscular portion of the diaphragm.

Some cases of this form of the disease are also related in the first volume of Medical Observations and Inquiries, by Dr. G. Macauley.

Danger. When the unnatural aperture is small, the patient suffers fre-

quently from the usual symptoms of hernia, and is in danger of being destroyed by a strangulation of the protruded parts as in other herniæ.

In the year 1798, I published the history of an interesting case of this description, which I shall take the liberty of relating here.

Sarah Homan, æt. twenty-eight, had, from her childhood, been Case. afflicted with oppression in breathing. As she advanced in years, the least hurry in exercise, or exertion of strength, produced pain in her left side, a frequent cough, and very laborious respiration.

These symptoms were unaccompanied with any other marks of disease; and, as her appetite was good, she grew fat, and, to common observation, appeared healthy. The family with whom she lived suspected her of indolence, and her complaints being considered as a pretext for the non-performance of her duty, she was forced to undertake employments of the most laborious kind.

This treatment she supported with patience, though often ready to sink under its consequences. After any great exertion, she was frequently attacked with pain in the upper part of the abdomen, with vomiting, and a sensation, as she expressed it, of something dragging to the right side; which sensation she always referred to the region of the stomach.

The cessation of these symptoms used to be sudden, as their accession. After suffering severely for a short time, all the pain and sickness ceased, and allowed her to resume her usual employments.

As her age increased, she became more liable to a repetition of these attacks; and, as they were also of longer continuance than in the early part of life, she was at length rendered incapable of labouring for her support.

Some days previous to her death, she was seized with the usual symptoms of strangulated hernia; viz. frequent vomitings, costiveness, and pain: the pain was confined to the upper part of the abdomen, which was tense and sore when pressed.

As these symptoms were unaccompanied with any local swelling which indicated the existence of hernia, they were supposed to be produced by an inflammation of the intestines; but there were other symptoms that could not be attributed to this cause, which occasioned much obscurity with respect to the true nature of the complaint, and seemed to indicate a disease in the thorax. She was unable to lie on her right side, had a constant pain in the left, a cough, difficulty of breathing, attended with the same dragging sensation of which she had formerly complained.

The signs of inflammation of the intestines, with the addition of a troublesome cough, continued without abatement for three days, when she expressed herself better in these respects; but the morbid symptom in the thorax remained as violent as at first: and in the fourth day from their commencement she expired.

Dissection.

On examining the body after death, when the abdomen was opened, there appeared a very unusual disposition of the viscera. The stomach, and left lobe of the liver, were thrust from their natural situation towards the right side. On tracing the convolutions of the small intestines, they were found to retain their usual situation; but lines of inflammation extended along such of their surfaces as lay in contact. This appearance the adhesive inflammation assumes in its early stage; and it is highly probable, that, if the approach of death had been less rapid, these surfaces of the intestines would have been glued together by the effusion of coagulated lymph.

When the large intestines were examined, the great arch of the colon, instead of being stretched from one kidney to the other, was discovered to have escaped into the left cavity of the chest, through an aperture in the diaphragm. The cœcum and beginning of the colon were much distended with air, and appeared therefore larger than natural; but the colon, on the left side, as it descended toward the rectum, was smaller than it is commonly found.

A small part only of the omentum could be discovered in the cavity of the abdomen, a considerable portion of it having been

protruded into the chest, through the same opening by which the arch of the colon had passed. The displacement of the stomach, and left lobe of the liver, had arisen from the altered position of the colon and omentum; which, in their preternatural course towards the diaphragm, occupied the situation of each of these parts.

When the chest was examined, the left lung did not appear of more than one third its natural size; it was placed at the upper part of the thorax, and was united to the pleura costalis by recent adhesions. The protruded omentum and colon were found at the lower part of the left cavity of the chest, between the lung and the diaphragm, floating in a pint of bloody-coloured serum. The colon, in colour, was darker than usual; in texture, softer, and distended with feculent matter mixed with a brownish mucus. The portion of the intestine contained within the chest measured eleven inches. The omentum was also slightly altered in colour, being rather darker than natural; but, in other respects, this viscus was not changed; it adhered firmly to the edge of the aperture, and more than half of its substance was contained within the chest.

The opening through which these viscera had protruded, was placed in the muscular part of the diaphragm, three inches from the œsophagus; it was of a circular figure, and two inches in diameter; its edge was smooth, but thicker than the other parts of the muscle.

The peritoneum terminated abruptly at the edge of this aperture, so that the protruding parts were not contained in a sac, as in cases of common hernia, but floated loosely, and without a covering, in the cavity of the chest, of which they occupied so large a space, as to occasion considerable pressure on the left lung, and to produce the diminution I have before remarked.

The right side of the chest, also the right lung and the heart, were free from disease.

Could the precise nature of this disease be ascertained during

the life of the patient, but little could be done for her relief; no more, than, perhaps, her own feelings would dictate, the refraining from all kinds of bodily exertion.

From laceration. The third cause of this form of hernia is a wound, or laceration of the diaphragm, and the former inflicted with the small sword, has been the most frequent. The opening is at first prevented from closing, by the pressure of the abdominal viscera, which frequently protrude through it, in small quantity at first; but at length, should the patient survive, very large portions escape.

The only instance in which I have known this disease produced by accident, has been from laceration of the diaphragm, in consequence of the fracture of several of the ribs.

Case. William Rattley, aged thirty, was admitted into Guy's Hospital. About one o'clock on February 5, 1804, having fallen from the height of about thirty-six feet, by which six of the lower ribs on the right side were fractured. When admitted, he breathed with great difficulty, and complained of excessive pain; the crepitus from the fractured ribs could be distinctly felt, and there was slight emphysema. Soon after his admission, he vomited violently, had frequent hiccough, and expired about eight o'clock on the following morning.

Dissection. The following appearances presented themselves on inspecting the body after death. A small wound at the inferior and posterior part of the right lung, with some slight but recent adhesions between the two portions of pleura. On pressing down the diaphragm, a portion of intestine was discovered in the cavity of the chest on the right side, of a livid colour. On examining the cavity of the abdomen, this fold of intestine proved to be a part of the ilium, which passed upwards behind the liver, through the lacerated opening in the diaphragm, into the chest. The aperture in the diaphragm was situated about two inches from the cordiform tendon on the right side, in the muscular structure; it was filled by the intestine, which was confined by a firm stricture. The laceration had been occasioned by the fractured end of the

tenth rib. The other viscera of the abdomen were otherwise but little altered; but near a quart of bloody serum was extravasated into the cavities of the chest and abdomen.

OF THE MESENTERIC HERNIA.

This hernia occurs in consequence of a natural deficiency of one Cause. of the layers composing the mesentery, or from an accidental aperture being made.

The intestines force themselves into such an opening, and, Formation. quitting the proper cavity of the peritoneum, form a hernia, which may become of very large size, as the cellular union of the two layers is not sufficiently firm to offer much resistance to the pressure of the protruding viscera.

Mr. Pugh, of Gracechurch Street, afforded me an opportunity Case. of examining a hernia of this kind. The subject in which it was found, had been brought for dissection to St. Thomas's Hospital; and the man had been a patient under Mr. Forster, in Guy's Hospital, just previous to his death.

On opening the abdomen, and raising the omentum and colon, Appearances. the small intestines were not to be seen, but a large swelling was discovered, situated over the lumbar vertebræ, and reaching to the basis of the sacrum; which, on further examination, proved to be a sac of peritoneum, containing the small intestines, and surrounding them completely, excepting at the posterior part, where the aperture by which the intestines had escaped, was situated.

From what I could collect of the previous history of the patient, he did not appear to have been much inconvenienced by this unnatural position of the viscera.

OF THE MESOCOLIC HERNIA.

The formation of this hernia is similar to that last described; and the first example I had an opportunity of examining, was, as the former, in a subject brought to the Hospital for dissection.

Appearances.

The abdomen having been opened, and the omentum and large intestines turned up, a tumour was discovered on the left side of the cavity, extending from over the left kidney, to the edge of the pelvic cavity, the lower portion being situated in the fold of the sigmoid flexure of the colon. The large intestines took their usual course, only that the cœcum was nearer to the centre than in common. On the left side, the colon was raised by the tumour. The duodenum, a small part of the jejunum, and termination of the ilium, were the only parts of the small intestines to be seen, on first opening the abdomen, all the rest being situated in the sac, having protruded by an aperture on its right side, which was large enough to admit two folds of intestine in a distended state.

Dr. Jones's case.

The sac was formed by the peritoneal layers of the mesocolon. Dr. Jones, of Barbadoes, sent me a drawing, exhibiting the larger part of the moveable viscera, between the layers of the peritoneum, as found when examining the body of a patient he had attended.

OF STRANGULATION OF THE INTESTINE WITHIN THE ABDOMEN.

This I have known to occur in several different ways.

Causes.

First. - From the intestine protruding through an aperture in the omentum, mesentery, or mesocolon.

Second.—From the same circumstance occurring when small openings are left in the adhesions formed in consequence of inflammation.

Third.—From a membranous band formed at the mouth of a hernial sac, becoming elongated, and entangling the intestine when it has been returned from the hernial sac.

Fourth.—From the appendix vermiformis entangling the intestine.

: R. Crookes, surgeon, of Barnsley, in Yorkshire, sent me account of a case in which a portion of intestine had been protruded through an opening in the omentum, and had become gangrenated. The patient was eighty years of age, and had been

previously very healthy and active. The case terminated fatally, two days after the commencement of the symptoms; and on examination after death, the intestine was found in a gangrenous state.

A case in which a portion of small intestine had protruded through an opening in the mesentery, and become strangulated, occurred under the care of Mr. Palmer, of Hereford. The symptoms were severe, but the patient survived until the ninth day from their commencement.

Dr. Monro has related a case of this nature in his work on crural hernia.

Mr. Hodson, of Lewes, attended a young man who died in consequence of the strangulation of a fold of small intestine, which had protruded through an aperture left in an adhesion of the omentum to the peritoneum.

I have a very excellent specimen, showing the strangulation of intestine by elongated membranous bands. It was taken from the body of a patient of Mr. Weston's, of Shoreditch. The patient was eighty-five years of age, and resided in Hoxton Workhouse. He was seized with symptoms of strangulated hernia, in consequence of which Mr. Weston was sent for, who, on examining the man, found a hernia on the right side, which he soon reduced by the taxis. The symptoms, however, continued, and the patient died. On examining his body after death, I found that the intestine had been returned into the cavity of the abdomen, but that two folds of it were entangled and strangulated by a long membranous band.

In the Museum at Guy's Hospital is a beautiful preparation, showing a considerable portion of the small intestine, surrounded and strangulated by the appendix vermiformis; but I am not acquainted with the history of the patient from whom it was taken. Specimen in Guy's Museum.

As the precise nature of any of the above cases could not be ascertained during the lives of the patients, no benefit could be derived from surgical aid.

LECTURE XLVII.

ON WOUNDS.

Of four kinds. SOLUTIONS of continuity on the surface of the body are of four kinds, according to the manner in which they are produced; viz. Incised, Lacerated, Contused, and Punctured.

Incised, when produced by a cutting instrument; lacerated, when the parts are forcibly rent asunder; contused, when occasioned by some heavy body, or one passing with great velocity; and, punctured, if made by a pointed substance.

This division of wounds is attended with advantage in the description of their treatment, as it must in some degree vary from the mode of their production.

OF THE INCISED WOUND.

Character. The lips of the divided parts are more or less separated according to the extent of the injury; and the division of the muscles, which, by their contraction, lead to a gaping state of the wound, as in the cheek, the lips, or in transverse incisions in the limbs.

The wound is covered with blood, which is florid or purple, as an artery or vein has been injured. If an artery, the blood flows by jets rapidly, and is of a florid colour; if a vein, the bleeding is slow, gradually filling the wound, and the blood is of a purple colour. Fainting is produced if an artery be cut, but rarely, if the bleeding be venous. Fainting also results if the wound extends to parts of vital importance, even although the hæmorrhage be very slight.

Treatment. When you are called to a case of incised wound, you are to make pressure upon its surface with a sponge to arrest the hæmorrhage, and if the divided vessels be small, you will soon find it subside under a steady and continued pressure. But if an artery of any magnitude has been injured, it should be drawn from the surrounding parts by a pair of forceps, or raised by a tena-

culum, and then tied with a very fine ligature ; one end of which should afterwards be cut off, that no more space than is absolutely necessary may be occupied by the thread or silk.

So soon as the bleeding ceases, the coagulated blood is to be completely sponged away from the surface and edges of the wound, the edges are to be brought together, and a strip of lint or linen moistened with the blood, is to be placed on the part in the direction of the wound, when the blood, by coagulating, glues the edges together in the most efficient and natural manner ; adhesive plaister is to be applied over the lint, with spaces between to allow of the escape of blood or serum.

In a few hours, inflammation arises, and fibrin becomes effused upon the surfaces and edges of the wound, by which they become cemented. How closed.

In a few days, vessels shoot into the fibrin, effused by the inflammation ; and it becomes organized with arteries and veins, and after a time, with absorbents and nerves ; thus the structure of the part is restored. Organized.

If the wound be in a muscular part, more especially in transverse wounds of muscles, it is required that the position of the limb be carefully attended to, that the wounded muscle may be relaxed as much as possible, and its separated portions approximated. Thus, if the biceps muscle were divided in the arm, the limb must be bent at right angles ; and if the triceps be injured, extension will be necessary. Wound of muscle.

But if the wound has happened in a muscular part, which is not supported, as in the cheek, a suture is required to preserve approximation ; the thread employed should be as fine as possible, and only as many as are absolutely necessary, to produce the desired effect, should be inserted. Sutures required.

If a wound be angular, and of considerable extent, a suture at the angle is desirable, or the edges will seldom be returned in their proper situation.

It is quite a mistake to suppose that sutures are injurious, and that they should be never used ; for a wound often heals better Not injurious.

with a suture and a cooling lotion, than with adhesive plaister. Indeed, adhesive plaister should not be applied to the edges of wounds. Often have I seen it produce erysipelas, and sometimes the erysipelas followed by the death of the patient. After the removal of a large tumour from the breast, I often employ a suture to keep the parts in exact contact, and to prevent the edges from becoming inverted.

Reproduction
of parts.

When the wound is healed, the parts wounded are generally reproduced. The cutis, and cuticle, easily; the rete mucosum, more slowly. The cellular membrane is for some time indurated, and requires the use and motion of the parts, to be completely evolved.

A number of branches of arteries and veins are formed instead of the original trunks. Nerves are reproduced. Tendons are also again formed. Bones are united by bone.

Muscle not
reproduced.

But some parts are not reproduced. There is a specimen in the collection at St. Thomas's Hospital, in which a wound of a muscle is seen united by a tendinous structure. There is also a specimen of a cartilage of a rib united by bone, but in young persons cartilage is reproduced.

Parts nearly
separated unite
readily.

Parts which are nearly separated readily unite, as the finger or the nose when it has been cut, or torn, and a suture is required to aid its union.

Parts entirely
separated will
unite.

Parts entirely separated in other animals sometimes unite. Mr. Hunter removed the spur of a cock, and placed it in the comb by incision, where it not only adhered, but grew. He also removed the testis of a cock, and placed it in the belly of a hen, where it adhered. A tooth extracted from the human subject, and placed in the comb of a cock, adheres there.

The only instance in which I have seen a part removed entirely, and afterwards adhere, was in the following case:—

I amputated a thumb for a patient in Guy's Hospital; and, finding that I had not preserved a sufficient quantity of skin to cover the stump, I cut out a piece from the thumb which I had removed, and applied it upon the stump, confining it by strips of

adhesive plaister. On taking off the dressings a few days after the operation, I found, that the portion which had been completely separated, and afterwards placed upon the stump, was firmly united and organized.

The most extraordinary instance of the union of a separated part has been related by Dr. Balfour, in the *Edinburgh Medical and Surgical Journal*, for October 1814, from which the following account is taken :

“ On the 10th of June last, two men came to my shop about Case. eleven o'clock in the forenoon ; one of whom, George Pedie, a house carpenter, had a handkerchief wrapped round his left hand, from which the blood was slowly dropping. Upon uncovering the hand, I found one-half of the index finger wanting. I asked him what had become of the amputated part. He told me that he had never looked after it, but believed that it would be found where the accident happened. I immediately dispatched his companion to look for it, and to bring it to me directly he found it. During his absence I examined the wound, which began near the upper end of the second phalanx on the thumb side, and terminated about the third phalanx on the other side. The wound, which had been inflicted with a hatchet, was quite clean.

“ In about five minutes, the piece of the finger was brought : it was quite cold, and white in appearance, like a bit of a candle. I immediately exposed both surfaces to a stream of cold water, to wash the blood off the one, and any dirt that might adhere from the other. I then applied, with as much accuracy as possible, the wounded surfaces to each other, expressing a confident opinion, that reunion would take place.

“ I endeavoured to inspire the patient with the same hopes, but he did not appear convinced of the possibility of such an occurrence. I informed him, that unless pain, or foetor, or both should occur, I would not remove the dressings for a week at least. I directed him to keep his arm in a sling, and not to attempt any kind of work ; to which he promised obedience. He called on me the next day, when he was quite easy, but the wound had bled

a little. Although he promised to call on me daily, I did not see him again till the fourth of July. I had concluded, that he had applied to some other practitioner; but, on the second of July, a gentleman called on me, and gave me the following account of the patient:—

“ Two days after the accident, the patient, under the influence of the ridicule of his acquaintance for giving credit to my assurances, applied to another practitioner; who, on learning the history of the case, represented the impropriety of any one but myself intermeddling with it. But, prepossessed with the belief that he carried about a portion of dead matter tied to the stump of his finger, the man insisted upon having the bandages removed, which was accordingly done. Thus were nearly rendered abortive my attempts to produce reunion of the parts, and the profession deprived of a fact, which, as demonstrating the powers of nature to repair injuries, is inferior to none in the annals of the healing art. Fortunately, however, nature had been too busy for even this early interference to defeat her purpose,—adhesion had taken place.

“ In consequence of the information I got from this gentleman, I found out the patient on the fourth, when reunion of the parts was complete. The finger was in fact the handsomest the man had, and had recovered both heat and sensation. In the progress of the cure, the skin was changed, and soon after the accident the nail fell off.

“ From the account of persons present when the injury was inflicted, I am satisfied that twenty minutes must have elapsed before the parts were replaced; for the patient did not come to me immediately upon receiving the injury, but waited a considerable time in the building where the accident happened.

“ The amputated part, as measured by the patient himself, was one inch and a half long, on the thumb side, and one inch on the opposite side.”

Adhesion prevents danger.

When adhesion of the incised wounds can be completely effected, the danger ceases. An incised wound into the abdomen, exposing

its different viscera, is not followed by danger if the wound is made to unite. Wounds of the chest, even complicated with injury to the lungs, cease to be dangerous under the adhesive process. Wounds of the brain will unite by adhesion, and the patient recover.

Union by adhesion is prevented by the following circumstances in incised wounds :— Adhesion prevented.

1. By the introduction of many, and of large sutures. It is therefore necessary to employ the finest threads, and to cut off one of their ends, that they may occupy as little space as possible; and in from four to six days, they should be removed; thus they are prevented from producing suppuration and ulceration. By sutures.

2. By the inflammation being suffered to run too high from want of bleeding generally, or locally, by leeches; or, from not employing cooling evaporating lotions. Spirits of wine and water, or acetate of lead and water, should be applied upon the wound, and around it. Purging is also often required. By too much inflammation.

The adhesive inflammation is but a slow degree of action, and if it be not kept in bounds, suppuration will occur.

If poisons be introduced into wounds, it will be wrong to attempt to produce adhesion; thus the bite of a rabid animal should be excised, as well as cauterized afterwards, to prevent the terribly dangerous consequences of such an injury. By poisons.

The use of caustic applications, whether by potash, nitric acid, the actual cautery, &c., will necessarily prevent adhesions. By caustics.

When many absorbent vessels are divided, the lymph poured out by them prevents adhesion, as I have seen in a transverse wound in the groin. When an absorbent is divided.

When the secretory glands are wounded, their secretion prevents union. Or a secerning gland.

I was called to a gentleman who fell upon his face on an earthen plate, which he broke; his face was dreadfully wounded; I brought the parts together, and in ten days they appeared to be united, when I allowed him to eat; but the result was a profuse Case.

discharge of saliva from the wound, which was a very long time in healing, on account of the parotid duct having been cut across.

By the surgeon's
imprudence.

Union by adhesion is often frustrated by the surgeon's impatience; he is anxious to see if union be effected or not, and most absurdly and mischievously raises the dressings, disturbing, and often breaking, the adhesions, and thus rendering the process of granulation necessary, when it might have been avoided.

By state of
constitution.

The adhesive inflammation is often prevented by the state of the constitution; if the patient be much out of health, or if he be extremely irritable, the inflammation will proceed beyond the bounds of adhesion, and suppuration will take place. In such persons, evaporating lotions to the wound, and opium internally, are the means of arresting the mischief which will otherwise ensue.

Adhesion not
always desirable.

It is not always an object to endeavour to produce adhesion; when there is much loss of substance, and the parts must be forcibly drawn together, much additional pain and irritation are occasioned by the attempt at adhesive union, and this is more especially the case in children, when the skin cannot well bear the application of the adhesive plaister. Therefore, when I remove those marks which are called *nævi materni**, I do not attempt to bring the edges of the wound together; but only, after the bleeding has ceased, apply lint for twenty-four hours, and then a poultice to the part by which much pain and irritation are avoided. The breast I often dress in the same manner, after the removal of tumours connected with much disease of the integument.

Nævi materni.

OF LACERATED WOUNDS.

Character.

These wounds bleed much less than the incised, for a reason which will be described when we speak of wounds of arteries;

* *NÆVUS MATERNUS*.—A mother's mark, which is congenital, and is said to be produced by the longing of the mother for particular things, or her aversion to them. Hence these marks resemble mulberries, strawberries, &c., &c.

but here it is sufficient to say, that the largest arteries of limbs may be torn through without any dangerous bleeding occurring.

Lacerated wounds also differ from incised, in their often containing extraneous bodies. Those of the scalp are frequently filled with dirt, from the head ploughing the ground, and the utmost care is required to cleanse them with warm water, and to remove with a sponge all extraneous matter, as I have seen such a wound adhere, and afterwards suppurate in various places, for the discharge of the foreign bodies which the adhesive matter had at first confined.

Differ from incised.

Lacerated wounds are more disposed to inflame, than the incised, and they require much more attention to the use of evaporating lotions, and of leeches to suppress it.

More disposed to inflame.

The nervous system frequently suffers severely from lacerated wounds. Spasms of the limbs, and tetanus, I have often seen follow these lacerations on the hand.

Affect the nervous system.

I was sent for to see a young gentleman at Marlow, who had fallen into a hedge and torn his hand with a thorn bush; he died from tetanus. In the hospitals, from lacerated wounds of the fingers, made by machines for combing wool, I have several times known tetanus produced; the tendons and fascia in these cases had been much exposed and injured.

Case.

Erysipelas is not an unusual effect of lacerated wounds, more especially if they are inflicted on the scalp, and they therefore require great attention, although they at first appear of trifling importance.

Produce erysipelas.

The treatment of these wounds is the same as that which has been described for incised wounds; but more care is required in the use of cooling lotions, and the application of leeches, in quiet, and in the exhibition of opium under the first appearance of spasmodic symptoms.

Treatment.

Patients with lacerated wounds, should not be much reduced by depletion, as it disposes to tetanic symptoms.

LECTURE XLVIII.

OF CONTUSED WOUNDS.

Character.

THESE injuries differ from the incised and lacerated wounds, in being accompanied with disorganization: blood is extravasated, the cellular tissue is broken down, muscles are bruised, and many parts disorganized.

Process of reparation.

The process of restoration is therefore quite different to that which takes place after incised or lacerated wounds.

Sloughing.

Inflammation to a considerable extent must be produced; the dead parts must be separated by a process of ulceration, and granulations will arise to fill up the cavities occasioned by these separations. The surgeon, therefore, who treats these wounds as he would the incised or lacerated, has still to learn the fundamental principles of his profession.

Contused wounds bleed but little, from the organization of the parts being destroyed, and from the extravasation making pressure upon the vessels which are divided.

Treatment.

The treatment of the contused wound in principle consists in facilitating the separation of the contused parts, instead of approximation, as in the incised and lacerated wounds. To effect this object, and to expedite the process, fomentations and poultices are to be used, which lessen inflammation when too violent, and hasten the suppurative and ulcerative processes. If the inflammation be still considerable, leeches should be applied; but bleeding ought not to be had recourse to from the arm, for all the powers of the constitution are required to assist in the process of separation and of granulation.

Medicines.

The bowels should be kept regular; but opium should be combined with the medicines given, to effect that object. If the constitution become much debilitated, the sulphate of quinine may be given; or ammonia, combined with opium.

Applications.

When the sloughing, or separating process is completed, the

fomentations and poultices are to be abandoned, and the parts may be approximated by adhesive plaister, or simple dressing be applied to the wound, treating it as a simple ulcer.

OF PUNCTURED WOUNDS.

These wounds are produced by pointed bodies, as needles, scissors, hooks, points of broken bones, &c.; and the effects which follow them are often highly dangerous, by occasioning inflammation of the absorbents; or when tendinous structures or nerves are injured. Danger of.

OF THEIR EFFECTS UPON THE ABSORBENTS.

A slight wound through the skin into the cellular tissue, will be sometimes followed by severe pain in the part, a blush around it, and by the absorbent vessels forming red lines, from the wound to the absorbent glands in which they terminate.

Of this effect I have seen very many examples, and I have been a sufferer from it myself. Abscesses sometimes form upon the absorbents, in their course to the axilla, or to the groin; and sometimes in the glands in which they terminate; and in very irritable persons death sometimes ensues; and the following example of it I had an opportunity of inspecting. Consequences.

A West Indian, studying at Guy's Hospital, wounded his finger, the absorbents of his arm became inflamed, and he laboured under excessive irritative fever; the veins seemed to suffer also from inflammation communicated to them, for his limbs became almost incapable of motion, from the violent pain produced by bending any of the joints, and the superficial veins of his limbs were very tender when pressed. He died in six days after the attack, and I inspected his arm. The absorbents of the limb were highly inflamed; and in the axilla matter was effused, not in a separate abscess, but in a sheet of suppuration in the cellular tissue, between and around the absorbent vessels. I was not permitted to inspect the body further. Case.

Case.

After an inflammation of this kind in myself, produced by wounding my finger when opening the body of a man executed on the same morning, my throat became sore as the inflammation in the absorbents of my arm subsided, and one of my knees became stiff from rheumatism; when this was subdued by a blister, the other knee became similarly affected.

Poison absorbed.

It would seem that under certain circumstances a poison is produced sufficiently strong to excite inflammation, even when there is no wound.

Case.

Mr. Cook, surgeon, at Marsh-gate, Westminster Bridge, sent to me whilst he was labouring under the highest irritative fever, in consequence of having opened the body of a person who had died of puerperal fever. When I examined him, I found the extremities of his fingers of both hands inflamed, as if they had been dipped in scalding water, and the absorbents of his arms red, hard, and knotted, to the axilla; yet he had not any wound or abrasion of any kind upon his hands; and it would therefore seem, that the fluid produced in the abdomen of this woman, in which his fingers had been frequently immersed, was of a highly stimulating nature.

Form of wound and state of constitution.

The effect of punctured wounds depends, however, very much upon the form of the wound, and the state of the constitution. When punctures have been made, by a clean needle, the tongue of a knee-buckle, a fragment of bone, &c., nothing can be introduced of a poisonous nature, and the effect must depend upon the form of the wound, and the structure injured. But the effect also depends upon the state of the constitution, as is evinced in our young students suffering in the spring, after confinement in London, in the air of our dissecting room, and in the wards of our hospitals, and by their escaping these violent symptoms in the autumn, when they have just quitted the country.

I believe, therefore, that these effects arise from the form of the wound, and the state of the constitution; also occasionally, but rarely, from the introduction of an irritating fluid, the result of

peculiar inflammation, or the production of the first stage of putrefaction.

I have known the bites of cats, dogs, and rats followed by high inflammation, and constitutional irritation, many days after the injury has been inflicted; and these cases unite the symptoms of punctured and contused wounds; the first effects upon the constitution arise from the punctures of their pointed teeth; but when the symptoms produced from this cause subside, from fifteen to twenty days after, I have known the injured parts inflame and slough; the constitution, as well as the part, undergoes great changes, and the patient becomes excessively reduced.

Bites of dogs
and cats.

The treatment of punctured wounds consists in adopting the following plan:— Treatment.

First.—A lancet should be used to extend the puncture to an incision.

Second.—The surrounding parts should be pressed to remove, by the blood which issues, any extraneous matter which may have been introduced. If the finger is wounded, a piece of string or tape should be bound tightly round the injured finger, from its junction with the hand, as far as the wound, so as to force out blood from the opening.

Third.—The nitric acid, nitrate of silver, or caustic of potash, should be applied to the wound.

Fourth.—A lotion composed of the subacetate of lead; spirits of wine and water should be applied over the part, to prevent too much action when inflammation begins.

Fifth.—Leeches should be applied, and fomentations with poultices employed, if the pain and inflammation become considerable.

Sixth.—Give calomel and opium at night, and a brisk purgative in the morning.

Seventh.—Let the limb be supported on an inclined plane, so that the blood shall gravitate towards the body; all stimulating food and drink should be avoided; a measure so absurd that a caution against it appears unnecessary; but an anatomist killed

himself by taking wine to oppose the putrefactive influence of the matter he supposed to be absorbed.

Inflammation
returns.

The inflammation from punctures of the hand in dissecting, will continue a long time, and be resumed when it seems to be at an end; attention to the general health, and to the part, must be therefore regarded closely, for a considerable period after the injury.

OF PUNCTURED WOUNDS OF TENDINOUS STRUCTURE.

Danger of.

If fascia be punctured, alarming symptoms will sometimes arise, in part from the form of the wound, from the feeble power of the structure, and partly from the confinement of matter beneath the fascia.

Form of the
wound.

The form of the wound produces these symptoms, because the parts are rather forcibly separated than actually divided, and consequently the adhesive process does not readily succeed. The structure of tendons and fasciæ, from their little vascular organization, and difficult restoration, leads to much constitutional effort; and the form of fascia tends to confine the pus when it is secreted.

Case.

A gentleman sat upon a rail, from which a nail projected, and it entered the middle and back part of his thigh; great irritative fever followed, with redness and swelling of the thigh; and, as fomentations and poultices, and calomel with opium, did not relieve him, I made an incision in the situation of the puncture, and found that the nail had penetrated the fascia lata; I divided it freely, when some pus, which had formed under it, was discharged. He quickly recovered.

Early incisions.

When a puncture is made into a theca, suppuration is apt to ensue, when an early incision, by allowing the discharge of the matter, prevents the greatest mischiefs.

If matter forms under the aponeurosis of the palm of the hand, an early incision is the only mode of relief, if the puncture which

occasioned the suppuration is too small to admit of the escape of the pus.

The treatment, therefore, of these wounds, consists in endeavouring to prevent suppuration by leeches, and evaporating lotions, in the first instance; but, if matter does form, to open the abscess early, both with a view of making the punctured an incised wound, and to give a free outlet for the escape of the pus. Treatment.

ON THE EFFECTS OF PUNCTURED WOUNDS ON THE NERVOUS SYSTEM.

The spasmodic and tetanic symptoms which follow punctured wounds, are the effects of injury to tendinous, rather than nervous parts. Most of the cases of tetanus which I have seen occur from punctured wounds, have been when the hand or foot has been the seat of injury; the aponeurosis of the palm, or sole, or the tendons being hurt. I will not deny that an injury to a nerve will produce the same effect; but I cannot help doubting its being the usual cause. Tetanic symptoms.

I divided the posterior tibial nerve in a Mrs. Sabine, the wife of a surgeon at Dunchurch, for a painful tumour on it; and little constitutional irritation was produced by the operation. Case.

I removed a tumour from the median nerve of a gentleman, and cut away two-thirds of the thickness of the nerve, leaving one-third; tingling of the fingers, with some partial numbness, followed, but no constitutional irritation; and he did very well. Case.

I cut out five-eighths of an inch of the radial nerve, for aura epileptica; and no unpleasant symptom followed, but the patient got well. Case.

Mr. Key removed a portion of the cubital nerve, for aura epileptica; and, although it did not cure the woman, it produced no unfavourable symptoms.

These instances, to which many more might be added, as well as the usual seat of the wound, which produces tetanus, lead me to

believe that it is rather the result of injury to tendinous than to nervous structures.

Extensive injuries, by their sympathetic influence, and by their severe shock to the nervous system, produce the destruction of life, even without vascular reaction or inflammation.

The symptoms which arise are sometimes only general spasm, sometimes trismus, and sometimes tetanus.

Case. I once saw a boy die, in a few hours, of the most violent spasms of most of the muscles of his body, from the pointed extremity of a broken thigh-bone having penetrated the under side of the rectus femoris.

Case. I saw a person die from spasm, produced by a punctured wound in the triangular ligament of the pubes, from a sharp piece of wood; and I have seen a great number of such cases from injury to the hand and foot.

Degree of spasm varies. Sometimes, instead of this general spasm, the influence of the wound is particularly felt in the muscles of the jaw, producing trismus, with the subsequent affection of the muscles of volition, and afterwards those of respiration, constituting tetanus. Sometimes the muscles of the posterior part of the trunk are more particularly affected, when the term *opisthotonos* is applied to the disease; and sometimes, on the contrary, the muscles of the anterior part are chiefly attacked, when the disease is named *emprosthotonos*. In the first case, the body is curved forcibly backwards; and, in the second instance, forwards. The muscles of the extremities become also extremely rigid and contracted, so that the joints cannot be moved; and, in the greater number of cases, life is destroyed in a few days.

Tetanus, acute and chronic. However, it may be observed, that there are two kinds of tetanus; one of an acute form, which generally terminates the patient's existence; and the other, of a chronic nature, which, after a time, is often recovered from.

Treatment. The treatment which I have seen pursued in acute tetanus, has been,—

The warm bath, which gives a temporary tranquillity, and slightly reduces the spasms; but is not followed by any permanent good effects. Warm bath.

Bleeding, which hastens the patient's death; it reduces the powers of the body; and, although the spasms are less violent, they destroy sooner. Bleeding.

Opium, I have generally seen given; but, in acute tetanus, never with any other advantage than a slight mitigation of the symptoms for a short period. I once saw Mr. Stocker give, at nine o'clock in the evening, half an ounce of tincture of opium, and at eleven o'clock an ounce more, without any permanent beneficial influence. To me, it appears to be absurd to resort to a treatment which has been repeatedly found to be inefficacious. Opium.

Tobacco injections I have seen used, but with no permanent advantage. Tobacco.

Digitalis I have known employed, but uselessly. Digitalis.

Ice I have seen extensively applied; but all these means, in acute instances, fail. Cold.

Mr. Ward, of Gloucester, has lately published two cases, which were relieved by the hydrocyanic acid. Cases.

Chronic tetanus I have known relieved by calomel and opium, by the cold and shower baths, by large doses of the tincture of muriate of iron; but I have also known persons recover who had scarcely taken any medicine; thus throwing a doubt upon the efficacy of those which had, in other cases, been supposed to be beneficial. Treatment of chronic tetanus.

In every instance, in which I have witnessed the existence of trismus, the patient has recovered. Calomel and opium are the best medicines; and a blister to the head the most efficacious local remedy. Trismus rarely fatal.

LECTURE XLIX.

OF WOUNDS OF ARTERIES.

Division.

THESE wounds we shall divide, as wounds in general, into the Incised, Lacerated, Contused, and Punctured.

When an artery is cut into, or divided, the immediate effect of such injury is to occasion an impetuous hæmorrhage of florid blood, which, if the artery be large, whizzes through the wound. It flows in pulsation in obedience to the action of the heart.

If the wounded orifice, nearest to the heart, be compressed, the blood from the opening, most remote from the heart, flows in an uninterrupted stream, and is of a dark venous colour, owing to its having passed through capillary vessels.

Fainting produced.

The brain soon ceases to be supplied with blood, and fainting is produced: sensation and volition become suspended; and the action of the heart is in a great degree suppressed; the flow of blood from the wound becomes much diminished, and sometimes entirely ceases.

Recovery from fainting.

In a few minutes the patient opens his eyes, and the power of the nervous system is restored.

Modes of arresting the bleeding.

The mode by which bleeding is arrested may be either constitutional or local. Fainting is the constitutional mode, by suspending the voluntary and involuntary functions, more especially in the diminution of the action of the heart, so that the blood scarcely reaches the wound, but it undulates in the heart, and large vessels under the fluttering of the heart.

Local means.

The local means consist in, first, the coagulation of the blood, which is effected in the cellular tissue around the artery, and also in the extremity of the wounded vessel, forming a plug; so that there is a continuation of coagulum from the outer surface to the orifice, and this sufficiently opposes the issue of blood under the enfeebled action of the heart.

But this process is also aided by the contraction of the artery, not particularly at the divided part, but also to a considerable extent from the orifice. Contraction of the vessels.

If the carotid artery, on one side, be cut across, and examined after the death of the animal, the artery is found much smaller on the wounded side than on the other which has not been injured. This state of the vessel lessens the influence of the blood upon the wound.

A retraction of the artery also follows when the division of the vessel is complete; and, by withdrawing itself into the cellular membrane, the blood becomes effused around it, so as to compress its orifice. Thus, then, it appears that coagulation with contraction and retraction of the vessel, all concur to put a check to the bleeding. Retraction of the vessel.

These, then, are the immediate means; but it is required that a further process should take place, to render their effects permanent. Inflammation follows; and the clot of blood becomes glued to the inner surface of the vessel, whilst effusion into the surrounding parts creates pressure upon the artery so as to diminish its calibre; this inflammation also usually produces a union of the edges of the wound, or otherwise granulations arise, fill it, and thus it becomes closed. Process of inflammation.

The treatment, when an artery of not a very large size, is divided in an extremity, is to apply a tourniquet to compress the trunk from which it is supplied; this, with gentle pressure on the wound for a short time, will generally command the hæmorrhage, when the edges of the wound may be approximated, and union promoted, leaving on the tourniquet, so as to continue a moderate pressure on the trunk. Pressure.

But if the vessel be large, it is necessary to make an incision in the direction it takes, so as to expose the wounded portions, when a ligature must be placed above and below on each portion of the vessel. The ligatures should be small, and one of the ends removed after their application. Dr. Vetch first recommended the removal of one of the threads. Application of a ligature.

When an artery is not completely divided, its retraction is prevented, and a coagulum, with difficulty, forms in it, and, when formed, is easily forced off by the action of the heart. Hence, in a week or ten days after the injury, bleeding will sometimes occur; and repeated hæmorrhage will destroy the patient if a ligature be not applied. I have known the temporal artery bleed eleven days after its partial division, and when the wound in the integument was almost closed.

The treatment of this injury consists in completely dividing the vessel, when its retraction enables a coagulum to form in, and around it; but, if the artery be large, a ligature must be applied.

LACERATED ARTERIES.

These bleed comparatively little.

Case.

A sailor, on board a Margate Packet, was bringing up his vessel in the river, and having his leg in a coil of the cable, the anchor was unexpectedly let go, when the cable caught his thigh, and tore off his leg six inches above the knee, excepting that a small portion of skin still connected the parts externally; the bone was broken; the artery, vein, sciatic nerve, and muscles, were all completely separated. A handkerchief was bound around the wound, and he was brought to Guy's Hospital. The artery had ceased to bleed, but he had lost a considerable quantity of blood. I amputated his limb, and he proceeded favourably for ten days, when he was seized with tetanus, and died.

Case.

I have also seen the foot torn off above the ankle, and the bleeding stop without the aid of tourniquet or ligature.

Cheselden's case.

The case related by Cheselden, of the arm being torn off at the shoulder without much hæmorrhage, is known to every surgeon.

Causes which prevent bleeding.

There are two causes which operate to prevent bleeding:—

1. The cellular tissue is sometimes drawn over the mouth of the vessel, and makes a ligature upon it, which stops the blood.

2. Another state of the artery produces the same result, and in

which the mouth of the vessel remains open, the coats of the artery are excessively elongated, and its sides fall together so as to render its canals impermeable.

The best treatment is to apply ligatures upon lacerated arteries, if they be large; otherwise, when the powers of circulation are restored, there is a danger of hæmorrhage. Treatment.

OF PUNCTURED ARTERIES.

They produce different symptoms from the other wounds of arteries in this respect, that the external opening being small, the blood does not readily escape; and therefore coagulates in the cellular tissue, and forms a swelling there, which gradually increases in size as the blood issues from the wound in the artery; the impetus of the blood causes a pulsation; and the cellular membrane, around the extravasated blood, being condensed, forms a sac, which impedes the evolution of the swelling. The external wound heals, and thus an aneurism is formed. Consequences.

It may be said that it differs from an aneurismal swelling in the mode of its production; and this is true, but it still has the other characters of the disease, and requires the same treatment.

I have several times known it happen from bleeding in the arm; in one case the radial artery was wounded, but in all the other cases, the brachial artery. Puncture in bleeding.

The first case was in a patient at Guy's Hospital; a dresser of Mr. Lucas, senior, bled the man, and he came to me excessively alarmed, telling me what had happened, and that he had great difficulty in stopping the hæmorrhage, but had at last succeeded, by applying a very tight bandage. A short time afterwards the man came to Guy's, and showed his arm to Mr. Lucas, who, seeing the aneurism, and hearing the cause, told the man that he must submit to an operation, which the patient refused. In walking home, he met an old acquaintance, to whom he told the circumstances; this friend, who occasionally bled and drew teeth, said he would cure Case.

him, and inviting him into his shop, he put a lancet into the swelling, and finding blood impetuously escape, he as quickly escaped from his shop. The patient finding himself bleeding, fortunately put his hand upon the wound, and called for assistance. A bandage was bound tightly round his arm, and he went to St. Thomas's Hospital, where Mr. Cline operated upon him, when the radial artery, in consequence of a high division, was found to be the wounded vessel.

Case.

One of the apprentices at Guy's Hospital had the misfortune to wound the brachial artery in bleeding; he immediately perceived the nature of the mischief, but before he could arrest the bleeding, thirty-seven ounces of blood were lost. He bound up the arm extremely tight, and when the bandage was removed a few days after, an aneurismal swelling appeared at the fore part of the elbow, for which an operation was performed, of tying the artery at the part, an operation which was attended with great difficulty, and the patient died.

Case.

I once assisted Mr. Chandler in performing the operation for brachial aneurism, produced by bleeding; the sac was opened, and the orifices above and below were secured by ligatures, but still there was a free hæmorrhage, from an anastomosing vessel, which it was necessary to secure.

Treatment.

The treatment of this injury consists in the immediate binding up of the wound, and applying a tourniquet to the middle of the arm, which should press upon the artery, and upon the opposite side of the arm only, leaving the circulation by anastomosis as free as possible.

**If aneurism
forms.**

If an aneurism still follows this accident, the tourniquet is to be continued, as described in the lecture on aneurism.

Operation.

Should the tumour still continue to increase after this has been fully tried, it will be proper to make an incision upon the brachial artery, about midway between the elbow and shoulder joints, and place a ligature upon it, but upon no account cut down upon the wounded vessel at the elbow.

In one instance, after I had applied a ligature to the brachial artery, I was surprised to find the thread completely separated on the fifth day; but the ulcerative process was probably accelerated by the inflammation which existed previous to the application of the ligature. The patient recovered.

OF CONTUSED WOUNDS OF ARTERIES.

Gun-shot wounds and severe bruises sometimes destroy the vitality of a portion of artery. As it will afterwards slough, there is a remote danger in such a wound, which must be carefully guarded against. The slough will not separate until from eight to ten days, or more, after the wound has been inflicted; and then the patient, without precaution, may lose an immense quantity of blood, and sometimes be destroyed by the hæmorrhage. Danger of.

The slough opens the vessel upon its side; and, no retraction ensuing, the hæmorrhage is unrestrained by the coagulation of the blood.

In these cases, it is required that the patient should be kept at rest until the sloughing process be completed; and he must be instructed in the tightening of a tourniquet, which must be applied, and left constantly upon the limb, until all the sloughing has ceased. Treatment.

A gentleman received a shot through the calf of his leg, and was proceeding so well as to be suffered to sit up, and to put his limb to the floor; on the seventeenth day, he was seized with a severe bleeding, from the effects of which he sunk. Case.

ON THE TREATMENT OF WOUNDS OF PARTICULAR ARTERIES.

ARTERIES OF THE SCALP.

Wounds of these arteries require in their treatment,—first, a complete division of the injured vessel;—second, the application of pressure;—by the first, retraction is permitted, and future bleeding is prevented;—by the second, the present hæmorrhage is suppressed.

Case. I was called one night to see the son of Dr. Johnson, who was bleeding freely from the temporal artery, which had been opened by a leech. I did not like to make an incision, but advised the application of a small tourniquet, which completely succeeded ; and this instrument I should advise in all wounds of arteries of the scalp, as the means of pressure.

Of aneurism. In aneurism, from wounds of the arteries of the scalp, I have, in each case that I have operated upon, been obliged to open the aneurismal sac, and to tie each communicating artery.

The aneurisms which I have seen on the scalp from injury, have been in the temporal and posterior aural arteries, and have arisen from wounds and contusions.

CAROTID ARTERY.

Speedily fatal. The wounds of this artery are usually so speedily fatal, that surgery is rarely able to preserve life.

Securing the artery. In tying the artery the pars vaga must be excluded from the thread, and although the dissection of parts from the artery cannot be made at the moment of securing the ligature, yet when the hæmorrhage is stopped, a fresh ligature may be placed upon the artery alone, instead of depending upon that which has been of necessity employed at first.

SUBCLAVIAN ARTERY.

Torn. I have never seen this artery wounded, but I have seen it torn through.

Case. A man was brought into Guy's Hospital with a fracture of the clavicle, in which accident the shoulder was very forcibly drawn back to the spine. The dresser had to bleed this man in the injured arm, but little blood could be drawn ; and, thinking that he had not passed the lancet sufficiently deep, he plunged it so far as to wound the brachial artery. The blood which issued from the wound, was of a venous character, but it required a very

tight bandage to stop the hæmorrhage. Great tumefaction succeeded about the shoulder, gangrene began in the arm, great constitutional irritation followed, and the man died. Upon examination of the body after death, it was found that after the fracture of the clavicle, the scapula was forcibly drawn back, so that the subclavian artery was torn through, but a cord of cellular membrane united its ends, so that the extravasation of blood had been very slight.

AXILLARY.

Mr. Key operated, and tied the subclavian artery, on account of an aneurism of the axillary artery, which had been produced by a forcible extension of a dislocated os humeri. Mr. Key's case.

BRACHIAL ARTERY.

This artery I have often known wounded in bleeding.

A slight bandage, and a thick dossil of lint as a compress, have succeeded in healing the artery.

Wounded in
bleeding.
Treatment.

If aneurism forms, the tourniquet should be employed, as I have described; and if this does not succeed, apply a ligature upon the brachial artery. Make an incision in the middle of the arm, on the inner side of the biceps, and take care to exclude the vein and median nerve from the ligature.

When an aneu-
rism forms.

ULNAR ARTERY.

The wounds of this artery are usually at the lower part of the fore arm, where the vessel is situated, between the tendons of the flexor carpi ulnaris, and the flexor profundus; it is accompanied by the cubital nerve, which is placed close to the artery, and which must be carefully excluded from the ligatures. On account of the free anastomosis between this artery and the radial, the application of two ligatures, one above, and another below the opening into the vessel, is absolutely necessary to effectually stop the hæmorrhage.

Injuries of.

RADIAL ARTERY.

This artery is much more frequently wounded than the ulna, being in every respect more exposed. The application of two ligatures is equally necessary, as in the ulna, and for the same reason. This vessel is readily found on the outer side of the flexor carpi radialis, and it is not accompanied by any nerve of magnitude.

OF THE PALMAR ARTERIES.

Frequently
wounded.

Wounds of the palmar vessels are very frequent, but generally the bleeding may be stopped by steady and continued pressure, by means of a compress and bandage, and by a tourniquet on the brachial artery; the application of cold, and attention to position, will materially assist. Should these means fail to arrest the bleeding, and if the openings of the divided vessel cannot be easily found, it will be necessary to secure the ulna, or radial arteries, or both; as from the very free communication of these vessels, the securing of one only, will not, in many instances, prevent further bleeding. It will be best, however, in wounds of the superficial palmar arch, under such circumstances, first to put a ligature upon the ulna artery, and then try pressure again, before the radial is taken up; which should not be done unless a troublesome hæmorrhage continues. On the contrary, should the deep palmar arch be the seat of injury, and it become necessary to secure an artery, the radial should be first tied, and afterwards, provided the bleeding does not stop, the ulnar should be likewise secured.

OF THE FEMORAL ARTERY.

High up in the
groin.

If this artery be wounded high up in the groin, the finger must be thrust into the wound to stop the bleeding, until a compress can be applied upon the pubes, and the vessel be secured.

If it be wounded in the middle of the thigh, in the mode which I have described in the case of a relation of Mr. Saumarez, a large swelling will immediately form, and the artery will be deeply situated, under a large coagulum. A free incision must be made to give the surgeon ample room to proceed in securing the wounded vessel, a tourniquet being first applied. The direction of the incision will be that required in the operation for popliteal aneurism, only it must be more extensive. The coagulum, which is then exposed, must be scooped out from the wound by the fingers, and the parts be cleanly sponged. The tourniquet is then to be loosened, and the aperture in the vessel will be directly seen, when the tourniquet is to be again tightened, and two ligatures are to be placed in the artery, one above, and the other below the wound, an end of each thread being cut off; the edges of the wound are to be approximated, so as to favour the union by adhesion.

In the middle of the thigh.

Treatment.

It is always right in these cases to divide the artery, between the ligatures.

OF THE POPLITEAL ARTERY.

This vessel is so protected by the condyles of the os femoris, and so concealed behind the bone, that it is rarely lacerated, and when it is so, the wound must be highly dangerous, as it will be probably complicated with a division of the sciatic nerve.

Rarely wounded.

It was a case of this accident which first attracted my attention to surgery, and which taught me its value.

A foster brother of mine, named John Love, aged about thirteen years, was playing and fell, as a waggon was passing, and one of the wheels of the waggon went over the back of his knee, as he lay with his face to the ground. The waggon was stopped, and when he was drawn from under it, a stream of blood directly burst from his ham; a handkerchief was tied tightly over the wound, and he was put upon the waggon, and was carried home in a fainting state. Different surgeons in the neighbourhood were sent for; but when they heard the nature of the case they all made excuses;

Case.

one had a most dangerous case of fever, another was at a labour; a third with a pressing case of inflammation of the bowels; they were all engaged, and could not come, or, like the hare and many friends,—

“ She first, the stately bull implored,
And thus replied the mighty lord ;—
Since every beast alive can tell,
That I sincerely wish you well,
I may without offence pretend,
To take the freedom of a friend.
Love calls me hence,” &c.

Tired of waiting, an old woman (who was deemed a sorceress in the village) was applied to, and she sent back the messenger, saying, that the bleeding would be stopped by the time they returned; and so it was, for John Love had expired*.

This scene made a strong impression upon my mind, as it was the first death I had witnessed, and I was directly convinced how valuable a member of society a well informed surgeon must be, and how great a curse an ignorant surgeon was. If the artery could not have been tied, the limb might have been amputated.

Danger in tying
the artery.

In tying the artery in the ham, there is some danger of including the sciatic nerve, as it is placed above the artery in cutting into the ham, and it must be carefully avoided; the artery must be drawn from the vein where the large nerve is placed upon it. Mr. Cline once saw the nerve included in a ligature in the operation for popliteal aneurism, and the patient died in a few hours.

OF THE POSTERIOR TIBIAL ARTERY.

Rare at the
upper part.

These injuries at the upper part of the leg are very unfrequent, but they do sometimes occur.

* This is now fifty years ago, when a man who had recovered from the operation for popliteal aneurism, was deemed a sufficient curiosity to be annually shown to the students at our Hospitals.

A man was brought into Guy's Hospital, who had fallen from a considerable height, upon a cart, and an iron peg in the cart had passed through the calf of his leg, between the tibia and fibula; a profuse hæmorrhage ensued, but by the application of a tourniquet it was stopped. In six days the bleeding recurred, when the tourniquet was tightened, and the flow of blood was again suppressed; but in two days hæmorrhage again took place. I tied the femoral artery at the usual place, and for a week the man went on well, but then the bleeding was renewed, and I was obliged to amputate the limb. On examining it after removal, it was found that the iron had passed through the posterior tibial artery, at the origin of the anterior tibial, and had penetrated between the tibia and fibula. Case.

An immediate amputation would be the best course to pursue.

Immediate amputation.

I have several times known the posterior tibial artery wounded by the bone in compound fracture; once, in a patient of Mr. Chandler, and a piece of lint was forced into the wound, which stopped the bleeding, but it was followed by gangrene, of which the patient died. In compound fracture.

In a case of Mr. Lucas's, in Guy's Hospital, Mr. Pollard, his dresser, secured the artery, and the patient did well. Case.

A patient of Mr. Key's, a boy, upon whom a tourniquet was applied, had the bleeding restrained, and it did not return. Case.

In a patient of Mr. Travers's, it was wounded by a scythe, and was tied by Mr. Travers, in the theatre at St. Thomas's Hospital; the patient did well. Case.

It is sometimes wounded by the employment of the adze. I was called to a case at Hunton Bridge, Herts, by Mr. Wingfield, surgeon, at Market Street. The wound was small, and the artery cut, but not divided; the injury had happened three weeks before I saw the man; the bleedings had been very frequent, and were restrained for a time by pressure on the wound, by means of a tourniquet. Case.

As the man had become excessively reduced by the last hæmorrhage, and could not have survived another, as soon as I was called

in I tied the artery; just as I had secured the vessel, the man fainted, and I thought he would have died, but he ultimately recovered.

Treatment.

In wounds of this artery at the upper part of the limb, I should first apply a tourniquet, then place the limb in a bent position, so as to relax the gastrocnemius muscle, which I should raise from its attachment to the tibia, so as to expose the artery and its accompanying nerve, which I should be careful to exclude, whilst I put two ligatures upon the wounded vessel, and afterwards should carefully close the wound and unite by adhesion.

At the lower part.

At the lower part of the limb the artery is easily found, and secured behind the malleolus internus, it is accompanied by the posterior tibial nerve on its fibular side, which must be avoided.

Interossial artery.

A wound of the interossial artery I have never seen; but in the case of such a wound I should cut upon the vessel from the outer part of the leg, and seek it between the tibia and fibula, close to the fibula.

OF THE ANTERIOR TIBIAL.

Protected above.

This vessel is rarely wounded at the upper part of the limb, but frequently at the lower. Lying between the two bones above, it is much protected.

How secured.

When wounded at the upper part of the limb, an incision must be made on the outer side of the tibialis anticus to find it: a tenaculum, or a pair of forceps, must be employed to raise the wounded artery, to remove it from the interosseous ligament; and then two ligatures are to be applied upon it.

In compound fracture.

I have seen it wounded in compound fracture. First, in a brewer's servant, a patient of Mr. Birch's, in St. Thomas's Hospital; the artery being tied, the compound fracture proceeded quite favourably.

Case.

In a second case the result was singular. A man was brought into Guy's Hospital, with a compound fracture of the leg. A few days after his admission, he had a free hæmorrhage from the wound, which was stopped by the application of the tourniquet; but at

different intervals the bleeding was frequently renewed, and I was at length compelled to amputate his limb. Upon examining it afterwards, a spicula of bone was found penetrating the anterior tibial artery, and the opening into the vessel thus produced, had been enlarged by a process of ulceration, so as to give rise to the hæmorrhage.

When the anterior tibial artery is wounded low down in the leg, it must, when it is tied, be completely raised from the tendons of the tibialis anticus, and extensor proprius pollicis, between which it is placed; both ends must be secured. Operation.

This artery is sometimes wounded on the upper part of the foot, where it is placed upon the navicular bone, and the middle cuneiform, by a knife or chisel being dropped upon the foot. On the dorsum
of the foot.

Each extremity of the divided vessel must be carefully tied, otherwise the hæmorrhage will continue, on account of the free anastomosis of this artery with the plantar.

OF THE PLANTAR ARTERIES.

For a wound of either of these arteries, I should first try what the application of a bandage, with a compress upon the wound, and a tourniquet upon the thigh would effect, and should tie the posterior tibial artery, after an extended and unsuccessful trial of these means; for so deeply is the artery placed, and so situated amongst tendinous parts and nerves, that incisions should not be made at the wounded part. Treatment.

STYPTICS.

In bleeding from small vessels on wounded surfaces, very fine wool, laid down and confined by bandage upon the part, is one of the best styptics. The wool may be dipped in flour to add to its efficacy. Wool.

Turpentine is said to have power as a styptic, and I have seen bleedings stopped by it when it has been applied by lint, and with Turpentine.

pressure; but merely poured upon the wounded surface it appears to me to be quite powerless.

An old prescription.

There is an old prescription for a styptic in St. Thomas's Hospital, which I have seen useful.

R. Pulv : Catechu

Pulv : Bol : Armen : aa ʒij.

Alum : ust : ʒj.

Tinct : opii. q. s. ut fiat pasta.

This will stop the troublesome bleeding from leech-bites.

LECTURE L.

OF WOUNDS OF VEINS.

Travers's paper.

Mr. Travers has published a very good paper upon the mode in which they heal.

In healthy persons not dangerous.

In a healthy constitution they are little dangerous, as the cellular tissue adheres over the apertures which have been made in them, and inflammation speedily closes them.

Case.

I once saw the axillary vein wounded in removing a scirrhus gland from the axilla; a dossil of lint was placed in the wound, and the arm was confined to the side, when no bleeding of consequence ensued.

In unhealthy persons dangerous.

In unhealthy constitutions they inflame and suppurate; they also ulcerate, and sometimes life is destroyed, by bleeding or by the inflammation extending to the large vein, and to the heart.

Several cases of this kind I have witnessed; and in the greater number the wound of the vein had been made to abstract blood for inflammation of the lungs; and I have thought that the inflammation of the vein was the result of the impediment to the pulmonary circulation.

Symptoms of inflammation.

The patient, in a few hours after the bleeding, complains of tenderness in the arm, and requests to have the bandage loosened;

he next finds great pain in extending the limb; the wound looks red, and its lips are separated. Then the plexus of veins on the fore arm become swollen, hard, and very painful; afterwards the basilic vein of the upper arm feels as a solid body, and is much enlarged. High constitutional fever ensues. If the patient has sufficient power of constitution, abscesses form in the veins of the fore arm; and by opening these early, great relief is afforded; but if the habit be particularly feeble, the matter which is produced by the suppurative inflammation, does not point, but it remains in the veins, producing excessive constitutional irritation, which destroys life.

Upon inspecting the vein after death, it is found partly filled by adhesive matter, and in part by pus. There is in the collection at St. Thomas's Hospital, a beautiful specimen of abscess in the longitudinal sinus of the dura mater. I have seen the jugular vein inflamed and adherent throughout the greater part of its course. Appearances.

We have, in the collection at Guy's Hospital, the femoral and iliac veins obliterated, taken from a patient who had phlegmatia dolens; which disease has been extremely well described by Dr. Davis, in the "Medico-Chirurgical Transactions." Specimen.

But the worst cases of inflammation of veins which I have seen, have arisen from the application of ligatures to the vena saphena. Division of the saphena.

First, I have seen a disease like phlegmasia dolens follow the division of this vein. Consequences.

Secondly, numerous abscesses form and break, sometimes destroying life, at others producing excessive irritative fever, from which the patient has been with difficulty recovered. One patient became insane during the irritation, and did not afterwards recover her mental faculties.

Thirdly, they have died from suppurative inflammation, without any abscess appearing, and this is the cause of death after the operation of amputation, when it is performed during a very unhealthy state of the constitution. I have seen, under these circum-

stances, both artery and vein, in a stump, in a state of partial adhesion and suppuration.

I saw, in Paris, in 1792, a case in which life was destroyed by suppuration of the femoral vein, after a gun-shot wound.

OF THE TREATMENT OF WOUNDS OF VEINS.

Position.

The first and greatest object is to empty the veins as much as possible, by the position of the limb, which should be such as to allow of the gravitation of the blood to the heart. In the arm, an inclined plane; in the leg, the position for a fractured tibia. This prevents accumulation of blood, and distension of the vessels.

Gentle pressure.

Secondly, a roller from the extreme part of the limb, to the wound, wetted with the liquor plumbi subacetatis, and spirit should be applied to approximate the sides of the vein, and to make gentle pressure.

Thirdly, leeches should be freely applied, and if suppuration be produced, fomentations.

WOUNDS OF THE ABDOMEN.

Two kinds.

These injuries are of two kinds: 1. Those in which the cavity is opened, but the viscera are not wounded. 2. Those in which some of the viscera suffer.

First kind, often recovered from.

With respect to the first of these it is scarcely necessary to say, in the present state of surgical knowledge, that very extensive wounds of this description are often recovered from, as is proved by the operations for umbilical or ventral hernia, by the Cesarian section; and, recently, by the removal of enlarged ovaria*. But the most curious circumstance in these wounds, is the manner in which the intestines glide away from the sharpest instruments, and escape injury. I shall relate two cases:—

* See cases by Mr. Liston.

In the year 1785, my second year of being at the Hospital, a Case. gentleman came almost breathless to the Hospital; and finding me the only person there, requested that I would immediately accompany him. He took me to a house in the Borough; and, leading me up stairs, showed me into a room, where I found a female in her shift only, lying upon the floor, weltering in her blood. I with difficulty raised her, and placed her upon the bed she had just quitted. On examining her, I found four wounds in her throat; one of which was deep and extensive. These I closed by sutures; after which she was able to speak; and I then asked her what had induced her to commit the act; she made an incoherent reply; but repeated the word stomach two or three times, which induced me to raise her linen, when I was surprised to find her bowels exposed by a wound reaching nearly from the pubes to the ensiform cartilage of the sternum; for, after cutting her throat with a razor, she had ripped up her belly with it, and let out her bowels, but the intestines were still distended with air; and I had a difficulty in returning them into the abdomen. They had not received the smallest wound. Dr. Key now came into the room, and I proceeded to sew up this extensive opening; but she died in nine hours.

Mr. Tolman and myself were sent for to see a gentleman who Case. had stabbed himself in several parts of his abdomen, with an old rusty dirk, and had for some time afterwards concealed himself from his family. When found, it was discovered, that a portion of omentum protruded through one of the openings; this was carefully returned; but notwithstanding the dirk still possessed its point, the intestines were not injured, and he recovered without a bad symptom.

The free motions of the intestines upon each other, independent of the peristaltic motion, is a great preservative in wounds of, and blows upon the abdomen.

There is another curious circumstance in wounds into the abdo- Peculiar men; which is, that they immediately produce universal coldness symptoms, and paleness, with nausea and faintness, excepting in the operation

for strangulated hernia ; in which case the intestine has been accustomed to violence.

Treatment.

In the treatment of these wounds, it is best to make interrupted sutures ; the needle should penetrate the skin and muscles, but not the peritoneum. If the muscle be not included in the ligature, a hernia is sure afterwards to form ; and if the thread is introduced through the peritoneum, it adds much to the danger of abdominal inflammation.

Between the sutures, strips of plaister, or of lint dipped in blood, should be applied, and the patient should be freely bled from the arm. If the local inflammation be great, leeches should be employed ; purgatives must be avoided, and food must not be given for several days.

OF THE SECOND KIND OF WOUND OF THE ABDOMEN.

Rare.

Wounds of the abdomen, extending to the stomach, or intestines, are extremely rare.

Dangerous.

Their danger is much lessened, if the wounded portion of the viscus protrudes through the opening in the parietes ; for, if not, they are generally fatal.

WOUNDS OF THE STOMACH.

The best case which I have heard of, is related by Mr. Scott, in the medical communications, from which the following account is taken :—

Mr. Scott's case.

“ During the election for Weymouth, in March, 1784, Charles Thomas, a seaman, aged twenty-five, of a strong and healthy constitution, had the misfortune to receive a thrust with a small-sword on the left side of his body. The sword passed in between the second and third of the lower false ribs, and penetrated into the cavity of the abdomen in an horizontal direction, to the extent of more than five inches, as appeared afterwards by the mark upon the blade.

“ I saw him about half an hour after the accident. His whole appearance was then much altered; his countenance being quite collapsed, and covered with a cold sweat, while the pulse at his wrist was scarcely perceptible; he had also a constant hiccough, a frequent retching and vomiting of blood, and a considerable discharge of blood, and other fluids, from the external wound.

“ From the place and manner in which the sword had entered, and the symptoms that followed, I was led to conjecture that the stomach was wounded; and that this was certainly the case, I was soon convinced, on examining the fluid discharged by the external wound, and finding in it several small pieces of meat in a soft digested state, together with some particles of barley.

“ He had complained of thirst, and some barley-water had been given him to drink; but this had been immediately thrown up after passing the œsophagus. Other mild fluids were now tried, as were likewise a common saline draught, in an effervescent state, and some thebaic tincture, but with no better effect; and they were all instantly rejected, tinged with blood.

“ The retching and action of the stomach continuing to be very violent, and the patient complaining, at the same time, of a lump, or dead weight, as he termed it, in his inside, he was desired to drink some warm water; this was soon thrown up, accompanied with a good deal of barley in solid grains, with the surface slightly broken, and some pieces of meat in a half-digested state. More water being given him, it was quickly returned, tinged with blood, but, otherwise, nearly as pure as when swallowed.

“ I now proposed that we should avoid giving any thing farther by the mouth; but, as the spasms and hiccough were still very frequent, an emollient clyster was administered, by which a considerable quantity of fæces was discharged. Soon after this, another clyster, containing twelve ounces of barley-water, and ʒij of thebaic tincture, was thrown up, and the greater part of it retained. Warm fomentations were likewise applied externally; the surface of the wound was loosely dressed; and he was desired to lie as much as

possible upon the injured side, with a view to favour the discharge.

“ On the first of April, the day after the accident, the symptoms were still very unfavourable. His pulse continued low and languid, with a great prostration of strength, and a coldness of the extremities. He had had several rigours towards morning, and the spasms were sometimes very violent. He complained of extreme coldness over his whole body, and of a constant gnawing pain about the pit of his stomach, to which part warm fomentations were frequently applied.

“ A laxative clyster was again administered, which was followed by a copious discharge; soon after this, another clyster, consisting of fourteen ounces of veal broth, and two drachms of thebaic tincture, was thrown up and retained. A similar clyster was repeated in about four hours, with the same effect. Flannels, dipped in warm milk and water, were occasionally applied to his arms and legs, and hot bricks to the soles of his feet. He made a little water twice in the course of twenty-four hours; this was highly coloured, and deposited no sediment, though kept for a considerable time.

“ April 2. He had passed a restless night, and now complained of intense thirst. The hiccough and spasms were less frequent, but he suffered much from a constant burning pain in the lower part of his stomach. His pulse was small, and beat about 120 in a minute. The fomentations were applied as usual; and ʒvj of the sal: cathart: amar: were dissolved in some broth, and thrown up into the bowels as a laxative. This produced a considerable discharge of soft, slimy fæces, in which were several small pieces of clotted blood enveloped in mucus. After this, in the course of the day, three clysters of broth and thebaic tincture were thrown up and retained. He was desired to use the pulp of an orange occasionally, to allay his thirst, and to wash his mouth frequently with barley water acidulated with lemon juice.

“ April 3. I was called to him early in the morning, and told

he was at the point of death. A clergyman had been sent for at the same time to perform the last offices. The nurse informed me, that, whilst supported in bed to wash his mouth, he had been seized with a violent retching, accompanied with convulsions of the chest, but that nothing had been discharged from his stomach, except a small quantity of bloody fluid. When I saw him, the spasms still continued; his forehead and breast were covered with a cold sweat; his pulse was low and intermitted, so that it could only be felt at intervals; and his strength seemed to be quite exhausted. Warm fomentations were immediately applied to the region of the stomach; and, as there was always some of the veal broth kept in readiness, I threw up about fourteen ounces of it, with ʒij of the thebaic tincture. The violence of the symptoms was soon moderated, and he appeared very languid, and showed a disposition to sleep.

“ When I saw him about four hours afterwards, I was told that he had enjoyed some rest. His pulse was now regular, but small and quick; he was very weak, and just able to inform me, that, in washing his mouth, he had accidentally swallowed some of the liquor, and that this had thrown his stomach into violent action. About one pint of the broth was now injected without any addition. This was likewise retained, and repeated at intervals of five or six hours. He now made water frequently, which, upon standing, deposited a considerable quantity of sediment, of a light brick, or straw colour.

“ April 4. The hiccough, retching, and other unfavourable symptoms, were now entirely gone; but he still complained of a fixed pain in his stomach, accompanied with a sensation of heat, and of a soreness of the injured side, extending from the wound toward the middle of the abdomen. He was likewise troubled with thirst; his pulse was small, and about 110. The external wound had now begun to yield a discharge of good matter.

“ The same mode of treatment was continued, and the symptoms became daily more favourable. The broth was administered in clysters, to the amount of two quarts, or five pints a day. The

fomentations were continued externally, and his feet and hands were frequently bathed in warm milk and water. He voided his urine regularly, and in about the proportion of three pints in the twenty-four hours, though it sometimes considerably exceeded this quantity, and continued to deposit a great deal of sediment. A little of the sal: cathart: amar: was occasionally added to the clysters in order to stimulate and cleanse the intestines; after the fourth day, however, there was scarcely any fæculent matter discharged, but only a small quantity of viscid bile.

“On the 10th day from the time of his being wounded, he appeared to be very sensibly relieved; his thirst and febrile symptoms were much abated, and his pulse was regular, and about ninety. As he was in good spirits, and expressed a wish that he might be allowed to swallow something, I procured some calf's-foot jelly, made lukewarm, of which he ate half a pint, without feeling any bad consequences. The only remarkable circumstance that attended the first time of his swallowing, was, that it occasioned frequent eructations, and a great discharge of air; but this, according to his own account, produced rather a grateful sensation than otherwise. Next day he was allowed some new milk for breakfast, and some chicken broth for dinner. The nutritious clysters were continued, however, till the 16th day, though less frequently than before. From that period, for about a fortnight, he lived wholly on bread and milk, and light broth. He was then allowed chicken, veal, and other meats easy of digestion. The external wound had been healed for some time, and he recovered his strength very gradually. The only inconvenience he suffered was from costiveness, and a sense of soreness and stricture which extended from the external wound towards the middle of the abdomen. This was particularly felt after a violent expiration, or any sudden extension of the body, when, to use his own expression, his side was drawn inwards and upwards. The costiveness was obviated by mild laxatives and gently stimulating clysters, and went off entirely as the intestines recovered their true and natural action. The other complaint, which I apprehend to have originated

from an adhesion of the inflamed stomach to the peritoneum, seemed to go off gradually as he recovered his strength ; though it was still felt in a certain degree in stooping, walking quick, or any great exertion of the body. When I last heard of him, two months ago, he enjoyed good health *.

“ This case affords a striking instance of the resources and peculiar powers with which nature has endowed the animal machine, for its preservation, and for remedying any injury it may sustain. The treatment was such as was necessarily suggested by the symptoms. The wounded stomach was so extremely irritable, that even the mildest fluids increased the violence of its action, and were rejected; for had any substance, whether of medicine or aliment, been admitted, it would probably have interrupted the union of the divided parts in the first instance, or afterwards, by the action necessary for its expulsion through the pylorus.

“ The liquid contents of the stomach had been chiefly discharged by the external wound, though part of them must, no doubt, have passed into the cavity of the abdomen, and have been afterwards absorbed ; but the wound of the stomach collapsing, the barley and indigested meat were left, which increased the irritation, and occasioned the uneasiness and sense of weight he complained of, and which was, in a great measure, removed by the vomiting that took place upon his drinking the warm water.

“ He felt some relief after the retention of the first clyster, but at that time his strength was so reduced, and the symptoms were altogether so unfavourable, that neither himself, nor those who saw him, entertained any hopes of his recovery. It is indeed surprising what an extreme debility took place immediately after the accident, which could only arise from the nervous influence and general sympathy with a part so essential to life.

“ The accident that happened on the fourth day, induced me to persevere in the mode of treatment we had adopted. Indeed there

* This was in the September twelvemonth following, as the paper is dated, November 15, 1785.

was great encouragement to continue it, as the broth clysters were not only retained, but there was a proof of an absorption having taken place, by the secretion and evacuation of urine, which then began to be considerable. It is a generally received opinion, that clysters seldom pass beyond the valve of the colon: the contrary has indeed been observed in the volvulus or iliac passion, but in that case the natural action of the intestines is inverted, and a violent degree of anti-peristaltic motion prevails; in this case, however, the broth was thrown up in a very gradual manner; and though, perhaps, it did not pass the valve of the colon, in the first instance, I am inclined to believe, from the sudden manner in which the absorption was afterwards carried on, that a gentle degree of anti-peristaltic motion took place, whereby it (the broth) was impelled to the smaller intestines; this will appear less surprising, when we consider, that, in the natural action, the first impulse is communicated by the stomach, in discharging the digested aliment at the pylorus, and continued through the intestines in determining the fæculent matter downwards: but here the natural action was suspended, the stomach was at rest, and there was no foreign matter to be discharged.

“The advantages to be derived from throwing up a supply of fluid, and supporting nature in this manner, in particular cases of morbid affections of the digestive organs, will readily occur to the attentive practitioner.”

WOUNDS OF THE INTESTINES.

In operating for
herniæ.

In a small wound of the intestine, which I witnessed in strangulated hernia, under the operation, I pinched up the opening with a pair of forceps, and tied a thread around it; I then passed up the intestine to the mouth of the hernial sac, leaving the ligature to hang from the wound, and the patient recovered, but he had severe symptoms for several days.

Large wounds.

In a more considerable wound of the intestine, I should make an

uninterrupted suture, and return the intestine into the abdomen, letting the end of the ligature hang from the external wound, which I should otherwise close with great care. I well know that, in experiments on animals, the ligature has been cut off close to the intestine, which has been returned into the cavity of the abdomen, and the external wound has been afterwards closed, so as to leave the ligature to separate into the intestine. Now I do not clearly understand that this plan, in any way, adds to the patient's security; but, on the contrary, it increases his danger, in my opinion, if the process of adhesion be deficient.

In the treatment of these wounds, it is right, if the wound be in the small intestines, to keep the patient without food, and support him by clysters of broth, &c. If it be in the large intestines, after a few days, a little jelly may be allowed. Perfect quiet is to be observed; and, if there be much tenderness of the abdomen, leeches should be applied. Treatment.

Ruptures of the intestines from blows are more frequent accidents, arising from kicks of horses, falling upon projecting bodies, &c. The symptoms are, great depression, coldness, and paleness; the pulse is scarcely to be felt if the laceration be large, and the patient dies in from twelve to twenty-four hours after the accident, quite sensible to the last moment of his existence. Rupture of intestine.

But if the laceration be small, the symptoms are less violent; there is coldness, tension of the abdomen, vomiting, costiveness, and not the least disposition for food; there is subsequently great abdominal tenderness and great enervation.

A patient was brought into Guy's Hospital, under the care of Mr. Forster; the man had been working in a gravel-pit, when the gravel fell in upon him. He vomited, his abdomen became tense, and as he made scarcely any urine, the case had been thought to be retention of urine. The man died six days after the accident, and, on examination after death, a rupture was found in the intestines. Case.

The treatment in these cases, is perfect rest, to prevent any disturbance of the adhesive process, to apply leeches and foment- Treatment.

ations to the abdomen, to avoid giving any medicine, and to check the desire of friends in giving food for several days after the accident.

Sometimes recovered from.

The intestines thus remaining for a length of time at rest*, and inflammation being kept within the adhesive bounds, I have seen (what I believe to have been) cases of this injury recovered from.

WOUNDS OF THE LIVER.

Case.

I have seen deep stabs with a pen-knife, in the situation of this organ, recovered from, after great inflammation in the abdomen. The patient was bled generally and by leeches, and fomentations were employed. Adhesive plaister had been applied to the stabs, and on its being removed, a bloody serum was discharged from the wounds.

WOUND OF THE GALL BLADDER.

Mr. Edlin, of Uxbridge, informed me of the following case:—Two soldiers quarrelled, and one struck the other with his bayonet in the right side, just below the margin of the ribs. The wounded man directly fainted and fell; when he recovered from his fainting state, he complained of agonizing pain in his abdomen, which became extremely tense and tender to the touch. In thirteen hours the man died; and, on examination of the body, the gall bladder was found to have been penetrated by the bayonet, and bile was extravasated into the abdomen. Mr. Edlin said, that wherever the bile rested, the peritoneum was highly inflamed.

WOUNDS OF THE SPLEEN.

Although this organ may be removed from the body, without

* The peristaltic motion is greater or less, as the intestines are full or empty.

the destruction of life, as is known from the case of the soldier mentioned by Dr. Gooch, and by numerous experiments on animals, yet a very small wound of it is sometimes destructive of life; the best example of which I shall give in the following case:—

A lieutenant of a press-gang was attempting to press a man, Case. who resisted with much violence; a scuffle ensued, and the lieutenant struck the man with his dirk, which entered near the ensiform cartilage, and its blade was nearly buried in the body. The man was brought to St. Thomas's Hospital, pale and extremely depressed, his abdomen became tense, and he died. Upon examining his body, it was discovered that the dirk had passed from the ensiform cartilage, under the margin of the chest into the abdomen, on the left side, and that its point had penetrated the concave surface of the spleen; the cavity of the abdomen was filled with fluid blood.

It is said, that the spleen has been often wounded by the tro- Wounded in tapping. char, when tapping was performed on the left side, which, under enlargement of this organ, might happen.

I have several times known the spleen ruptured by carriages Ruptured. going over the abdomen, and once by the horn of an ox. Each of these cases proved fatal.

Twice have I known the spleen torn from its natural attachment Case. to the diaphragm. The first instance, was in a patient of Drs. Babington and Letsom; a Miss Harris, who, having vomited violently, discovered soon after a swelling at the groin, and at the lower part of the abdomen. I was asked if it was hernia, and I declared it was not. She died after a week, vomiting constantly the liquids which she swallowed. When the abdomen was opened after her death, the swelling was found to arise from the spleen, which had been detached from the diaphragm, and was enlarged by the interruption to the return of blood from the veins, although the artery still contained blood. The spleen was turned half round on the axis of its vessels.

The other case was that of a gentleman who was hunting in Case.

Surrey; he fell from his horse when going at full speed. He died the following day, or the day after. Dr. Pitt, who attended him, examined the body after death, and found the spleen torn from the diaphragm.

Treatment.

In wounds or ruptures of the spleen, I believe nothing can be done. If the case could be accurately ascertained, pressure by a roller on the abdomen would be the best treatment.

WOUNDS OF THE KIDNEY.

A wound of this organ is not fatal.

Case.

A boy called at my house, and showed me some chalky concretions which he had coughed up from his lungs or bronchial glands. I said, "How long have you been subject to this complaint?" He answered, "Ever since I have passed blood with my urine." I asked him to explain himself further, when he told me, that when quarrelling with another boy, he had been struck with a pen-knife in his back; and almost immediately he wished to make water, when he passed a large quantity of blood. This continued for several days, but subsided by his remaining quiet in bed. The recumbent posture is in such a case the very best security.

WOUNDS OF THE BLADDER.

**Danger from
state of bladder.**

These are dangerous, or not, as the bladder is full or empty when the injury is inflicted. If full, urine is extravasated into the abdomen, or extensively into the cellular tissue, and death ensues. If empty, or nearly so, the danger is greatly lessened.

The bladder is sometimes ruptured when the above observations are applicable. The cause of its laceration is generally a fracture of the pubes.

Treatment.

The treatment of these cases, consists in leaving a catheter in the bladder, and enjoining perfect rest.

WOUNDS OF THE CHEST.

These are also of two kinds :—First, wounds of the parietes. Of two kinds.
Second, wounds of the viscera.

Wounds of the parietes are not attended with much danger. Of parietes.

A boy fell from a tree upon some pales, which entered his Case.
chest between the seventh and eighth ribs, tearing his intercostal
muscles freely. The air rushed violently into his chest at each
respiration, and was again expelled, when the anterior surface of
the lungs appeared at the wound. The edges of the wound were
brought together by adhesive plaister, a roller was applied tightly
round the chest to confine the motion of the ribs, and he was bled
very freely. He did extremely well.

A man was brought into St. Thomas's Hospital who had been Case.
stabbed between the cartilages of his ribs; he bled very profusely,
and I thought the internal mammary artery was wounded, but the
bleeding soon subsided, and he recovered.

The treatment in wounds of the parietes of the chest, is to
promote as much as possible the adhesive inflammation, to close
the wound externally.

If there be bleeding from the intercostal artery, the finger Hæmorrhage.
should be pressed upon the orifice of the vessel, until the disposi-
tion to hæmorrhage ceases.

A man died in Guy's Hospital, who had been wounded through Case.
the intercostal muscles with an iron spindle, the wound healed, but
tetanus supervened, of which he died. Upon inspecting the chest
after death, the lung was found to have assisted in closing the
wound, by adhering to the injured pleura.

OF WOUNDS OF THE LUNG.

When this happens, the circumstance is known by the patient's Symptoms.
coughing up florid and frothy blood; by free bleeding from the
wound, if sufficiently large to permit its escape; by considerable
irritation and tickling in the larynx, and by dyspnea.

Danger of.

Danger in three ways results from wounds of the lung. First, from hæmorrhage, if any large branch of the pulmonary artery is wounded. If the vessel be wounded by a sword or knife, it bleeds very freely; but if by a broken rib, very little, as it has the nature of a lacerated wound.

Treatment.

In either case, the patient must be freely bled, to prevent the continuance of the hæmorrhage from the wounded lung, and the opening must not be closed in the parietes until all bleeding from the lungs have ceased, otherwise the blood will remain in the cavity of the chest, and produce irritation and inflammation.

Danger from inflammation.

The second danger is from inflammation of the lung, and effusion into the cavity of the pleura. The first is to be guarded against by large and repeated bleedings, determined by the dyspnea and hardness of the pulse; but there is little danger of bleeding too much in one of these cases, as it is an object not only to diminish the force of the circulation, but the quantity of the blood in the pulmonary vessels.

If effusion follows, it is the result of neglected inflammation, or of having closed the external wound too early. In the one case, it is a purulent secretion; in the other a bloody serum, which produces the dyspnea some days after the accident.

Operation for effusion.

For effusion into the chest, it is right to perform the operation for paracentesis of the thorax, to draw off the pus or bloody serum which has collected in the pleura. The mode of doing this has been already described.

Effusion in old persons.

In old persons there is great danger in fractured ribs with wounded lung, and I always give a guarded opinion, for I have seen several die from effusion of fluid into the cellular tissue of the lung. The greatest care and quiet are therefore required in such a case, and it is better to give digitalis than to bleed very largely.

Emphysema, the third consequence of wounded lung, is less dangerous than the others. It sometimes extends to the face, covering the neck, and also a large part of the trunk.

Treatment.

In the treatment, a bandage is to be placed so tight around the

chest, as to prevent any rattling during a deep inspiration ; the patient is to lie on the wounded side, and punctures may be made into the cellular tissue, where it is much loaded, but not so large as the wound made in bleeding.

In all cases of wounds of the chest or lungs, rest is essentially necessary to recovery.

OF WOUNDS OF THE PERICARDIUM.

Mr. Saunders told me the following case, which occurred whilst he lived with Mr. Hills, of Barnstaple. Mr. Hills was called to Case. attend a man who, in a quarrel, had been wounded by another with a reaping-hook through the cartilages of the ribs. The wound was small, but deep, and the man had the appearance of one who had sustained a dangerous injury. In two or three days after, he had much pain in the region of his heart, a quick and small pulse ; and in a few days more, he began to swell, and could not lie down in bed. I forget exactly how long he lived, but I think for a fortnight or three weeks ; and after his death, it was discovered that the hook had passed through the cartilages of the ribs into the pericardium, in which there was an effusion of bloody pus.

WOUNDS OF THE HEART.

These wounds rarely occur, but in their consequences are so immediately fatal, as to preclude the possibility of affording relief. Two cases, however, of much interest, I have known, and of one there is a preparation in the museum of St. Thomas's Hospital. I will relate them.

The first case is published in the second volume of the "Medico-Chirurgical Transactions," and was sent to me by Mr. Featherton, who attended the patient.

"Richard Hollidge, a private in the Northampton regiment, Case. while on duty on the 29th of March, 1810, with an unfixed bayonet

in his hand, slipped down, and his bayonet entered his left side, between the sixth and seventh ribs, upon the superior edge of the latter. He was some yards distant from the gate at which he was posted, and being challenged, he returned to open it, with the bayonet still remaining in the wound; he was incapable of withdrawing it himself, but the person coming in extracted it for him. I was called to him within five minutes of the accident; he was then in a state of syncope, the extremities cold, and his pulse scarcely perceptible. In about the space of a quarter of an hour, he gradually revived, did not complain of any severe pain, and expressed, 'that he believed he was more frightened than hurt.' I examined the wound with much diligence, but could not trace its extent further than one inch and a quarter, though it was evident that the bayonet had penetrated two inches: the hæmorrhage was very inconsiderable. His wound was dressed; he was conveyed to the military hospital, and put to bed; he was incapable of lying on his right side, but slept tolerably well. On visiting him the following morning, he complained of lancinating pains extending from the wounded part across the chest, and of severe fugitive pains in different parts of the abdomen; his pulse was quick and thready, and tongue white and dry. These symptoms led to a suspicion, that the pleura costalis at least was wounded, though no opening could be ascertained extending into the cavity of the chest. ʒxvj. of blood were taken from his arm, a solution of sulphate of magnesia administered, and fomentations applied to the abdomen. He was obliged to be supported in bed nearly in a sitting posture, as respiration became much impeded when perfectly horizontal: in this position he appeared to breathe with freedom. In the evening, he expressed himself in every respect much relieved; his pulse was less quick, and had lost its thready sensation; tongue more moist; his medicine had operated moderately. On the following morning, I found he had passed a good night, his pulse was calm and steady, scarcely quicker than natural, and the tongue quite moist; the lancinating pains had subsided, and he merely complained of a trifling pain in the wounded part; this was

increased by a slight cough, with which he became affected only this morning, and which was unattended by any expectoration. His aperient draught was repeated, an emulsion ordered for his cough, and the antiphlogistic regimen strictly adhered to. Throughout the day he was walking about the ward, in very good spirits, quite jocular in his conversation with his fellow patients, and expressed himself to them, that 'low diet would not do for him any longer.' He retired to rest about nine o'clock, and fell asleep; at eleven, he got out of bed to the commode, had an evacuation, by no means costive; said, 'he felt himself chilly, and a sensation that he should die;' returned to bed, and expired immediately; forty-nine hours from his receiving the wound.

"I examined the body on the following morning, in the presence of two other surgeons. On opening the chest, the pleura was found slightly inflamed for some distance round the puncture, and an effusion of adhesive matter, emitting a small portion of the lung to the wounded part; the lung was not injured. At least two quarts of blood were effused into the cavity of the chest; the pericardium was nearly filled with blood, and had a puncture through it, extending three quarters of an inch into the muscular substance of the left ventricle, about two inches from its apex. A small coagulum was formed at the edge of the wound through the pericardium.

"Upon opening the left ventricle of the heart, it was discovered that the bayonet had penetrated the substance of the ventricle, and had cut one of the fleshy columns of the mitral valve.

"On a review of the case, I conceive it very curious, that an organ like the heart, possessing such excessive irritability, a point to which the most interesting of our sympathies are referred, and which is in some degree influenced by the most trifling, should be so materially wounded, and yet the system take so little cognizance of the injury. Death, in this case, it was perfectly evident, was not produced from any alarm excited in the system by the wound, but occurred as a secondary consequence, from the hæmorrhage increasing to such an extent, as to interrupt the actions of the

heart and lungs. That the hæmorrhage proceeded chiefly from the heart, must be admitted : there was no symptom whatever that indicated a wound of the lung ; none could be found on the most deliberate examination ; and the intercostal artery was entirely free from injury."

The second case has been published in the "Medical Records and Researches," from which the following particulars have been taken. It occurred during the time that Dr. Babington was employed as assistant surgeon at the Royal Hospital at Haslar, and by him the particulars were communicated:—

Case.

" Henry Thomas, a marine, was received into the hospital, from his Majesty's ship *Foudroyant*, having a wound in his side. He had slipped from the gangway, where he had been placed as sentinel, to the deck below ; and had fallen upon the point of his bayonet, which had penetrated his side a little below the false ribs, nearly in a perpendicular direction, as far as the hilt of the instrument. Immediately after the accident he drew out the bayonet without assistance, arose, took up his musket, walked eight or ten steps, and then dropped down in a fainting state ; from this state he soon recovered, and was taken to the hospital about two hours after the receipt of the injury ; he then complained of but little pain, was inclined to sleep, and when roused appeared in great distress. The wound was on the left side, about two inches above the ilium, and communicated with the cavity of the abdomen ; but neither its direction nor depth could be ascertained. His body was cold, his pulse scarcely perceptible, but he had not apparently lost much blood. A portion of omentum, about 3ij in weight, protruded through the opening ; this was cut off. A purgative enema was thrown up, which procured a motion, without any appearance of blood. He drank freely of coltsfoot tea, and took his medicines ; the fluids produced nausea and attempts to vomit, but he did not eject any thing from the stomach. The breathing was at first slow, but free ; by degrees it became more oppressed, and at length grew extremely quick and laborious, attended with a sense of weight on the right side of the thorax, which threatened suffo-

cation. The expectoration was not bloody. Soon after the injury he began to complain of a pain in the chest, and at the pit of the stomach, which gradually increased, and towards midnight became almost insufferable. The upper part of the thorax had swelled a little, and the motion of the right arm much increased his sufferings. This tumefaction gradually augmented, and at eleven o'clock had reached the head and face; it subsequently extended all over the body before his death, which took place a little after two o'clock in the morning, apparently from strangulation. He retained his senses to the last minute.

“ On examining the body twelve hours after death, the following appearances were discovered :—

“ The triangular wound from the bayonet, was seated on the left side, midway between the spine and the linea alba, having the last rib and the crista of the ilium at equal distances above and below it ; it readily admitted the point of the finger. A portion of omentum still protruded, and appeared gangrenous. The direction of the wound was obliquely upwards and inwards, and had penetrated the following parts :—the integument, abdominal muscles, peritoneum, the colon near its termination in the rectum, again at its arch ; the stomach inferiorly, two inches from the pylorus, and superiorly, under the left lobe of the liver, which was also wounded ; the diaphragm in the centre of the tendon ; after this the pericardium ; the right ventricle of the heart in two places, first the inferior part, and again near the tricuspid valve ; next the lungs were pierced ; and last the anterior parietes of the right side of the thorax, between the cartilages of the second and third ribs, terminating in the substance of the pectoral muscle. The abdomen contained a little bloody serum ; the pericardium a small quantity of blood ; but the right cavity of the pleura had about two quarts of blood within it.

“ Although so many parts of importance were injured, but little was indicated of the extent of mischief from the symptoms which occurred during life. Thus the colon was twice perforated, but the stools were not tinged with blood, nor was there any fœculent

matter in the cavity of the peritoneum. The stomach was also twice wounded, and yet vomiting did not take place, excepting once slightly, as he was brought to the hospital. The liver was opened to the extent of one inch, but yielded scarcely any hæmorrhage. The heart had been pierced in two places, but yet its action continued regular, and supported circulation for above nine hours. The middle and upper lobes of the right lung were both wounded; yet he did not cough up any blood. The emphysema had originated under the pectoral muscle, and had gradually extended over the whole body."

WOUNDS OF THE THROAT.

Parts injured.

Attempts to commit the act of suicide are the usual causes of these injuries, and usually one of the following parts suffer:—the pharynx, the larynx, the trachea, or the œsophagus.

Description of parts.

If the chin be a little elevated, its distance from the sternum is about nine inches. First: Three inches below is the thyroid cartilage, and the space has the muscles of the os hyoides and tongue on the fore part. Second: In the middle division is the larynx, with the pharynx behind it. Third: In the lower part is the trachea before, and the œsophagus behind. On the sides of these parts are situated the carotid arteries, which are divided near the os hyoides. The internal jugular veins are also placed laterally. The pars vaga accompany the carotid arteries, and the grand sympathetic nerves are found somewhat nearer the vertebræ.

OF THE WOUND ABOVE THE LARYNX.

This is the most frequent seat of injury, which is inflicted whilst the chin is elevated.

Symptoms.

Through the wound, air and blood issue with frightful impetuosity, more especially when the patient coughs. A lighted candle brought near the aperture is immediately blown out, and liquids,

when attempted to be swallowed, are violently ejected from the wound. Hence, those ignorant of the structure of the parts, suppose that the air tube is injured, but the anatomist is aware that the wound has passed through the muscles of the jaw and tongue into the pharynx, being generally inflicted between the chin and os hyoides.

The arteries, which bleed freely, are the sublingual, that pass just above the os hyoides on each side to the tongue; but sometimes the external carotid arteries are divided, when, from the rapid hæmorrhage, death is almost immediate. Arteries wounded.

TREATMENT.

The wound is generally in itself but little dangerous; and when persons die shortly after its infliction, it is frequently from the fever which has led to the commission of the act, if it be not from hæmorrhage.

Position in this wound is to be carefully attended to. If the chin be elevated, the wound gapes widely; but when the chin is depressed, the frightful aperture becomes closed; the head should therefore be brought down towards the chest, and confined in that position, in order to prevent a separation of the edges of the wound. Position.

I have generally put three sutures in the integument only, the more effectually to guard against any disturbance of the approximated edges, which may otherwise, from the constant motion of the patient during irritability or delirium, be produced. Such sutures, through the integument only, are in this respect very useful, and are not ever disadvantageous. Sutures.

The patient's mouth and tongue should be kept cool and moist, by the application of a portion of lemon dipped in water; but he should be chiefly supported by clysters of broth and gruel, to which opium should be added if they quickly return; and when the fever has subsided, the addition of port wine should be made. Enema.

I knew a lady who had a stricture in her œsophagus, who was supported forty-five days by clysters of broth and wine, when she could not swallow even a drop of water.

When food is given by the mouth, a small quantity of solid matter excites less irritation than fluid; and a small portion of jelly is the best.

The sutures should be removed in a week, and adhesive plaister be substituted for them.

When the wound is situated below the os hyoides, as it sometimes is, the epiglottis is injured at its junction with the thyroid cartilage.

In a case of this kind to which I was called at Walworth, I put a thread through the frœnum, on the dorsum of the epiglottis, and fixed it again to the thyroid cartilage. The man recovered; but whether it was post hoc, or propter hoc, God knows! In general, those cases are fatal, in which the epiglottis is separated from the thyroid cartilage, from a want of defence to the air tube.

OF THE WOUND INTO THE LARYNX.

Symptoms.

This wound is either into the thyroid or cricoid cartilages, or into the ligament which unites them.

The air rushes out through the wound in expiration, and violently in coughing, and is also inspired through it. The person is not able to speak, unless the aperture be closed by pressure; but the food does not pass out from it.

A wound confined to the cartilages of the larynx, or to the ligament uniting them, is not dangerous, and by far the greater number of these cases, which I have seen, have done well. The treatment of them consists in approximation of the parts by position, and in the application of adhesive plaister to retain the edges in contact.

When the wound is inflicted with excessive violence, or by a stab, the pharynx may be wounded, as it is situated behind the

larynx, and then the treatment of the wound is to be similar to that of the wound of the larynx.

In a case of this nature, which was under the care of Dr. Ludlow, of Calne, he informed me that the thyroid cartilage, which was many weeks in healing, became ossified, and that portions of it exfoliated. Case.

In a patient of mine in Guy's Hospital, the wound upon the thyroid cartilage remained fistulous, and I raised a piece of skin from the surface of the neck, above the opening, and turned it over the opening, the edges of which I had previously pared; it united extremely well. Case.

OF THE WOUND BELOW THE LARYNX.

When the wound is inflicted within three inches of the sternum, it is more dangerous than in any other situation. The trachea is here on the fore part, the œsophagus behind, and the carotid arteries are situated close to the trachea, more especially the right. The thyroid gland crosses the upper part of the trachea, and its veins cover the fore part.

If the trachea be cut, the air rushes through the wound both in expiration and inspiration. The blood gets into the trachea, and excites a violent coughing, by which a bloody froth is forcibly ejected, but the food or liquids do not pass out through the aperture. Symptoms.

The external opening, in these cases, is generally small, as the wound often arises from a stab, and the consequence is, that the blood does not freely escape, but lodging in the bronchia, adds excessively to the dyspnea.

In the treatment, the first object is to stop the bleeding; and if the wound be not sufficiently large to lead to the easy discovery of the source of the hæmorrhage, an incision should be made, in a longitudinal direction, to expose the mouths of the vessels. If the trachea be widely opened, pass a needle and ligature Treatment.

through the cellular tissue, upon its surface, which, from its firmness, will support the ligature, and thus bring the edges of the aperture into contact; but do not penetrate the trachea itself with the needle. Thus securing the trachea, bring the edges of the external wound together by bending the head forwards; but do not apply adhesive plaister, as it prevents the escape of air and blood in coughing, produces additional difficulty of breathing, and occasions emphysema.

The ligature upon the cellular covering of the trachea, is to be separated by the ulcerative process, which will generally be effected in a week.

A transverse wound in the trachea, will be followed sometimes by a loss of voice, on account of the division of the recurrent nerves.

If one of the carotid arteries be opened, death is usually so instantaneous that the patient cannot be saved. If a surgeon were present, or the wound was very small, and he could reach the patient before he expired, he should thrust his finger into the wound to stop the flow of blood, and then cut down upon the vessel, to expose it sufficiently to place a ligature upon it, which he can afterwards better adjust*.

When the trachea is deeply cut, the œsophagus is sometimes wounded; and, if the injury be extensive, death will generally ensue; but a stab into the œsophagus, or a small wound, may be recovered from.

After an injury of this kind, the wound into the trachea is to be treated as in the former instance, by which that in the œsophagus will be best approximated; all food, liquid or solid, must be avoided, and the patient is to be supported, as long as nature can bear it, by clysters. I object entirely to the introduction of tubes into the pharynx and œsophagus, as worse than unnecessary; for they are highly injurious by the cough which they occasion,

* See case of wounded carotid.

by their irritating the wound ; and if adhesion or granulation have taken place to close the wound, such tubes tear it open again and destroy the process of restoration.

LECTURE LI.

WOUNDS OF JOINTS.

THESE accidents are but trivial, or very dangerous, as the surgeon is directed by proper principles, or is ignorant of the treatment which they require.

If the patient has a poultice applied, or if the utmost attention be not paid to the immediate closure of the wound, inflammation of the synovial membrane arises, and suppuration ensues. The most violent constitutional irritation succeeds,—shivering, heat, flushing, and profuse perspiration ; generally, great swelling and excessive pain in the joint. Abscesses form in different parts of the joint, one succeeding another, until the strength becomes exhausted.

Improper treatment.

In young and healthy constitutions, these wounds in the largest joints are recoverable from ; but, in aged and weak persons, they destroy life.

In young or old persons.

Upon dissection in the first stage, suppurative inflammation of the synovial membrane is found ; in the second stage, the ligaments of the joint are thickened, and the synovial membrane in part ulcerated, in part granulating. The cartilages are absorbed ; granulations arising from some parts of the bones, and exfoliation taking place from other portions.

Dissection of.

Recovery from these injuries when inflammation has followed, is by adhesion, so as to destroy the synovial surface ; or else

Anchylosis.

of the tendon takes place to the surrounding parts, destroying permanently the action of the muscles, and the motions of the tendon. But if the wound be united by adhesion, and the ends of the divided tendon brought into contact, or nearly so, the motions of the foot are generally restored.

Treatment.

The principle in the treatment is to approximate the ends of the tendon by raising the heel, extending the foot, and bending the knee; the external wound is then to be carefully closed, in order that it may be healed by the adhesive inflammation. To effect this, a shoe with a heel one inch and a half in height is to be placed on the foot of the injured limb, and a strap is to be carried from the heel of the shoe to the calf of the leg, then a roller is to be lightly applied upon the upper part of the leg, to confine the strap and to keep the foot extended. The edges of the external wound are to be brought together by a small suture, and all pressure at the part should be avoided, only an evaporating lotion being placed upon it. The patient is to be confined to his bed until the wound be healed, and then he may be allowed to walk a little with a high-heeled shoe. This shoe is to have the heel gradually lowered until it becomes of the same thickness as the heel of the shoe worn on the sound side. By this means, the muscle which had contracted, and the tendon which had been injured, are gently brought to their proper action.

If the divided extremities of the tendon are allowed to remain separate during the union, an addition is made to the tendon in its length, and the power of the muscle acting upon it is thus reduced.

Should much inflammation arise during the cure, the limb must be elevated to prevent all gravitation of blood, and leeches should be applied near the wound.

Division of extensor tendons.

If the extensor tendons of the fingers be divided, the fingers should be kept extended during the cure, by a splint placed under the hand and fingers. Indeed, it is only necessary to consider whether the divided tendon, in any case, belongs to a flexor or extensor muscle, to know what is to be done to assist its union.

PUNCTURED WOUNDS OF TENDONS.

These are dangerous accidents, being often productive of tetanus. Several times within my knowledge, this has occurred from persons treading upon a nail, which has penetrated the shoe and wounded the tendinous aponeurosis of the sole of the foot; also an accident of a somewhat similar nature to the palm of the hand, I have seen productive of a similar effect. Dangerous.

Tetanus seems to be the result of the wound of a structure difficult to heal, and requiring great constitutional efforts to produce the effect; and these efforts, in a very irritable constitution, produce the highest nervous excitement. Tetanus.

In these injuries, I have observed that it is best to foment and poultice the parts, so as to soothe and tranquillize them; also to carefully avoid depletion, even from the first to any great extent, either locally or constitutionally. The patient should be allowed his common diet, and if he be restless, or complain of much pain in the wound, opium should be given. Lowering the patient only adds to his irritability. Treatment.

OF LACERATION OF TENDONS.

The tendo achillis, and sometimes, but not so frequently, other tendons are torn through. Of tendo achillis.

This accident to the tendo achillis is produced either by a violent effort of the muscles, as in jumping or dancing, or by an unexpected extension of the tendon;—as for instance, by treading unawares with the toe only upon an elevated substance. Dr. Curry, late physician to Guy's Hospital, informed me that he tore his tendo achillis by catching his toes upon a scraper, when walking in a dark street; being at the time unprepared for such an occurrence.

In whatever way the accident may be produced, the treatment required will be to extend the foot, and bend the knee to allow the ends of the lacerated tendon to approximate. In this way the Treatment.

tendon soon unites by the adhesive process, and the use of the limb is afterwards gradually restored. Some degree of thickening of the tendon for a long time remains, and the patient halts a little in rapid motion.

The position of the foot and leg is to be maintained in the same way as when the tendon is divided by incision, and an evaporating lotion should be employed. After the union, the same precautions are to be observed with respect to the employment of the high-heeled shoe.

OF PARTIAL LACERATION OF THE TENDO ACHILLIS AND GASTROCNEMIUS MUSCLE.

Cause of.

A person in running or walking fast, or if his foot slips backwards when it has been advanced, sometimes feels as if he had received a severe blow upon the back of his leg, and is immediately unable to walk but with the greatest difficulty, and with the foot extended.

The cause of this feeling is a laceration of some fibres of the tendo achillis, or of the gastrocnemius muscle, where it joins the tendon. There is great tenderness upon pressure on the following day, with some ecchymosis, which daily increases, until the limb becomes considerably discoloured. The least attempt to bend the foot is accompanied with great pain, and followed by swelling of the leg and ankle.

From a belief that the injury is slight, and from negligence in treating it, the lameness which results from this accident is often of very long continuance; but, if properly attended to from the first, it is in general soon recovered from.

A similar treatment to that recommended for division or laceration of the tendon, is requisite for the cure of this injury, and when the patient can bend the foot without producing pain, then the high-heeled shoe must be worn, and the heel be gradually lowered, as in the previous cases.

From three to six weeks are required to effect a cure.

OF WOUNDS OF THE NERVES.

The immediate effect of the division of a nerve of a limb, is the Effect of. loss of volition in those muscles to which the nerve is distributed, and the antagonist muscles being unopposed, gradually contract. If the nerve supplying the flexors is divided, the limb becomes extended; if that distributed to the extensors is separated, the opponent muscles keep the extremity flexed. This arises from the tendency a muscle possesses to occupy the smallest space possible, and which differs from voluntary or involuntary contraction, as the latter can only continue for a time; but the former is permanent, or as long as the antagonist muscles are paralysed.

The second effect of the division of a nerve is the diminution of sensibility; I call it diminished, because I do not find that the division of the branch of a nerve, although it benumbs the parts, entirely deprives them of sensation.

In the division of the infra orbital nerve, or of one of the nerves of the fingers, some sensation remains, but numbness is produced; when, however, all the nerves passing to an extremity are divided, sensation is entirely destroyed.

I once saw a case, in which one of the branches of the median Case. nerve was divided in the palm of the hand; and if pressure was made on the radio spiral nerve at the elbow, it produced a tingling sensation in the benumbed finger*.

The temperature of the part to which the nerve is distributed, if it be covered so as to prevent the access of a colder medium, is greater than that of parts similarly covered; but if it be left altogether bare, it then has less power of resisting diminished temperature than the surrounding parts. I have seen severe chilblains, and during the winter incurable ulceration, follow the division of the median nerve.

* It would appear by this that nervous influence is supported in a degree by anastomosis.

Divided nerves unite.

When a nerve has been divided, if its extremities are brought together, it unites, and the function of the nerve becomes gradually restored.

Dr. Haighton's experiments.

Dr. Haighton divided the *pars vaga* on one side of the neck of a dog, and, after some time, he cut through the nerve on the other side: the dog lived, which he would not have done, had both the nerves been divided at the same time. When he had allowed time for the union of the second, he divided both at once, and the animal died under the same circumstances as would have occurred had no previous experiment been made.

The time required for the union and restoration of function, appears to depend upon the size of the nerve.

Case.

A young gentleman who had injured the external condyle of the os humeri, had numbness in the direction of the radial nerve, and he recovered the sensibility of the parts in four months.

The numbness sometimes produced by bleeding is recovered from in three months.

In a fracture of the thigh bone, by which the sciatic nerve was injured, so as to produce numbness in the limb below, the person recovered in nine months.

Case.

Kosciusko, the Polish General, had his sciatic nerve injured by a pike, and when in this country, many months after receiving the wound, he had not got rid of the effects; and I have heard since, that he remained lame.

At the place of union, after the division of a nerve, there is the appearance of a ganglion, as may be seen in a preparation I made from the finger of a person brought into the dissecting room at St. Thomas's Hospital; a cicatrix covered the ganglion.

Independent of the size of a nerve, the time in which union will be complete, must also depend much on the position and approximation of the ends.

Treatment.

In the treatment of a wounded nerve, the only objects are the approximation of its ends and union by adhesion.

Many bad symptoms have been attributed to the partial division of a nerve; but I have, in part, cut through the sciatic nerve of

a dog, without producing any other symptom than partial paralysis.

I removed from the median nerve, a tumour for a gentleman, **Case.** and took away two-thirds of the nerve with it, and numbness with tingling were the only unpleasant symptoms following.

A Mr. H. called at my house, who had a partial division of the **Case.** median nerve, affecting the fore, middle, and ring fingers, but not the thumb; he had tingling with the numbness, but no other bad symptom.

A nerve divided in part, therefore, occasions tingling and numbness; one completely separated, only numbness: the treatment of the former is as that of the latter.

If a ligature be applied upon a nerve of magnitude, the consequences are sometimes fatal, and sometimes productive of lingering suffering. **Ligature on a nerve.**

Mr. Cline informed me, that in a case of popliteal aneurism, **Case.** operated upon in the old way, by opening the tumour in the ham, the popliteal nerve was included in the ligature with the artery, and the man died in a few hours.

In a case of amputation at Guy's Hospital, I saw the whole **Case.** sciatic nerve included in a ligature, which was applied to suppress hæmorrhage from the artery which accompanies the nerve. In four days, the man was seized with violent spasm in the stump. On the fifth day, spasms affected the limb, and from thence extended to the other muscles of the body. On the seventh day, he died.

If a nerve be included in a ligature, when tying an artery, the process of ulceration is extremely slow, and the slightest drawing of the ligature produces agonizing pain.

Lord Nelson suffered excessively from this cause after his limb **Case.** had been amputated; and with all his heroism, he could not bear the least touch of the ligature, without uttering the most violent expressions.

After amputation, then, it is right to avoid, with the greatest cir-

cumspection, any nerve, or portion of a nerve, in placing the ligatures on the vessels.

The division of a nerve, or even pressure upon the spinal marrow, so as to destroy volition and sensation, does not prevent the involuntary action of the limb or limbs from proceeding. The circulation still proceeds, and the irritability of the part remains, as is shown in the application of a blister, which produces the usual vesication ; also, a wound heals by the adhesive process.

Friction and electricity seem to have some influence in restoring action in a divided nerve, or of one which has partially lost its power from any other cause.

Pressure upon a nerve, occasions the sensation of a part being asleep ; striking the cubital nerve at the elbow, occasions violent tingling in the little finger, and half the ring finger.

OF SPRAINS.

Definition. A sprain is an injury occurring to the ligaments or tendons surrounding a joint, which are either forcibly stretched or lacerated.

How produced. It usually happens from the sudden extension of the joint in a direction which the muscles are unprepared for ; in the same manner as when a dislocation is produced, only that the violence is not sufficient to occasion a displacement of the bones.

Common seat of. The most common situations of these accidents are either at the wrist or ankle, arising from sudden falls, by which joints are unexpectedly and forcibly bent.

Symptoms. These injuries are attended with considerable pain at the time of the accident, and the part soon becomes swollen and tender ; the former symptom arises from the effusion of blood, in the first instance, out of the lacerated blood vessels, and becomes subsequently much increased from inflammation ; the tenderness and pain are generally in proportion to the tumefaction.

At first the surface of the skin presents its natural appearance,

but after a short time, as the effused blood coagulates it becomes much discoloured.

When inflammation has been set up, and given rise to effusion of fibrin, a sensation of crepitus is experienced on examining the injured part, which might, by an ignorant surgeon, be mistaken for the crepitus of fractured bone; but it never gives that distinct grating feeling which occurs from the rubbing of one portion of broken bone upon another.

Sensation of
crepitus.

Immediately after the receipt of the injury, the ordinary motions of the joints can be readily performed; but as the swelling takes place, these motions become much impeded, and ultimately cannot be performed without producing acute pain, and increasing the mischief.

Motion of joint
destroyed.

In the treatment of these cases, the first object is to arrest the hæmorrhage from the lacerated vessels, and then to prevent the occurrence of severe inflammation; afterwards to promote the absorption of the effused matter, and subsequently to restore the motions of the injured parts.

Treatment.

In the first instance, the application of cold by means of evaporating lotions, and attention to the position of the limb, will effect much in arresting the effusion, and preventing acute inflammation. The position should be such as to relax those muscles which act on the injured tendons, and at the same time such as will favour the return of blood to the heart.

Cold and posi-
tion.

Should the pain and tumefaction increase in spite of these means, leeches should be freely employed over the seat of mischief, and the bleeding encouraged by tepid applications; purgatives should also be administered; and in very robust persons, when the injury is extensive, general blood-letting, and other constitutional remedies must be had recourse to.

Bleeding.

When the inflammation is subdued, and the patient is free from pain, still the surgeon has much to do in effecting the absorption of the effused matter, and this he should be careful to remove, as it is from neglecting this stage of the injury that other and more

After effects.

important disease originates, this more particularly in persons suffering from any constitutional disease, as in those affected with scrofula.

In healthy persons.

In persons free from constitutional disease, these injuries, if not very extensive, are rapidly recovered from; the effusion quickly subsides, and the motions of the joint are restored; but in no case should the patient be allowed to exercise the part as usual, until all pain has ceased, and the part has nearly regained its original form.

Too early motion.

By a too early use of the part, the effects of the injury are kept up, so that weeks, months, or even years may elapse; and the patient still suffer from them; whereas a little more attention to the disease in the first instance, would have completely removed all the suffering and danger.

In unhealthy persons.

In persons suffering from constitutional disease, a chronic form of inflammation is often set up, which terminates in suppuration, and often affects the bones, which become carious, and make it necessary for the surgeon to remove the diseased part by amputation, in order to save the patient's life.

Therefore, after the acute symptoms have been removed, be careful to get rid of all the effects of the injury before the patient be allowed to employ the limb as previous to the accident.

Treatment of chronic stage.

Rest, position, and the use of mild stimulants, with friction, and moderate pressure, are the best means of producing the desired effect. The liniment: ammoniæ; liniment: hydrargyri; liniment: saponis, may either of them be rubbed over the affected part, night and morning, afterwards making pressure by the application of a roller; or the part may be enveloped in strips of one of the following plaisters:—empl: ammon:—empl: ammon: c hydrarg: empl: galbani, over which the roller should be placed. I have also known good effects produced from the pouring a continued stream of cold water on the part from a pump or large pitcher.

Should the disease prove obstinate, and be attended with occasional pain, the aid of counter irritation may with great advantage be produced, either in the form of blister, or the ung: antimon: tartarizat: I have known many cases quickly cured by these means.

When the marks of disease have been removed, the motions of Exercise. the parts should be promoted by moderate, but regular exercise.

ON DISLOCATIONS AND FRACTURES*.

TO THE

STUDENTS OF ST. THOMAS'S AND GUY'S HOSPITALS.

MY DEAR YOUNG FRIENDS,

This Work has been composed for your use ; and if you derive advantage from it, my principal object will be attained. I cannot, however, omit the opportunity of expressing my gratitude for the affectionate and respectful manner in which you have always received me as your instructor. Your parents, and relatives, many of whom were my pupils, are also entitled to my most grateful acknowledgments,—they fostered me in early life,—and by their friendship and recommendation have largely contributed to procure me a degree of success which, I fear, is beyond my merits, and a course of uninterrupted happiness which few have been permitted to enjoy.

Believe me, always,

Your affectionate Friend,

ASTLEY COOPER.

* Extracted from Sir Astley's large quarto work.

PLATE I. OF DISLOCATIONS,

Shews the positions of the limb in the different dislocations of the thigh-bone, and in the fracture of the cervix femoris.

Fig. 1. The thigh-bone dislocated *upwards* upon the dorsum ilii. The limb shortened,—the hip projecting,—the knee and foot turned inwards, and the toes resting on the metatarsal bones of the other foot; the head of the bone is thrown back, and the trochanter major forwards.

Fig. 2. Shews a dislocation *downwards* into the foramen ovale. The limb is longer than the other,—the knee advanced and separated from the other,—the toes pointed,—the heel does not touch the ground; the body is bent forwards: in all other accidents of this joint, the limb is lengthened.

Fig. 3. Dislocation into the ischiatic notch. The limb shortened,—the patella nearly an inch above the other,—the knee and foot turned slightly inwards,—with the great toe resting against the ball of the great toe of the other limb; the leg is separated with difficulty from the other.

Fig. 4. Dislocation of the os femoris upon the pubes. The head of the bone projecting at Poupart's ligament,—the knee and foot turned out and widely separated from the other,—the limb shortened a little.

Fig. 5. Fracture of the neck of the thigh-bone. The limb is shortened,—the knee and foot everted,—the limb may be easily drawn to the same length as the other, and then if rotated a crepitus will be felt.

ON DISLOCATIONS.

DISLOCATIONS IN GENERAL.

Definition.

A **DISLOCATION** is a displacement of the articulatory portion of a bone from the surface on which it was naturally received.

Necessity of prompt assistance.

Of the various accidents which happen to the body there are few which require more prompt assistance, or which more directly endanger the reputation of a surgeon, than cases of luxation. If much time shall have elapsed before the attempt at reduction is made, the difficulty of accomplishing it is proportionably increased, and not unfrequently becomes insuperable : and if the nature of the injury be unknown, and the luxation consequently be left unreduced, the patient will remain a living memorial of the surgeon's ignorance or inattention. "What is the matter with me?" said a patient who came to my house, placing himself before me and directing my attention to his shoulder : "Why, Sir, your arm is dislocated."—"Do you say so! Mr. ——— told me it was not out."—"How long has it been dislocated?"—"Many weeks," he replied.—"Oh, then you had better not have any attempt at reduction made."—He said, "Well, I will take care that Mr. ——— has no more bones to set; for I will expose his ignorance in that part of the country in which I live." He was a man of malevolent disposition, and carried his threat into execution, to the great injury of the surgeon, who was also frequently reminded of his want of skill, by meeting his former patient in his rounds; and what was worse, by hearing the following observation frequently repeated: "Mr. ——— is a good apothecary, but he knows nothing of surgery."

Instances of mistake.

In a dislocation of the os femoris, which still remains unreduced, a consultation was held upon the nature of the injury, and after a long deliberation, a report was made by one of the surgeons to this effect: "Well, Sir, thank God, we are all agreed that there is no dislocation." *Proh pudor!!!*

A considerable share of anatomical knowledge is required to detect the nature of these accidents, as well as to suggest the proper means of reduction; and it is much to be lamented, that students neglect to inform themselves sufficiently of the structure of the joints. They often dissect the muscles of a limb with great neatness and minuteness, and then throw it away, without any examination of the ligaments, cartilages, or ends of the bones; a knowledge of which, in a surgical point of view, is of infinitely greater importance; and from such negligence arise the errors into which those novices fall when they embark in the practice of their profession; for the dislocations of the hip, the elbow, and the shoulder, are scarcely to be detected, but by those who possess accurate anatomical information. Even our hospital surgeons, who have neglected their anatomy, mistake these accidents; and I have known the pulleys applied to an hospital patient, in a case of fracture of the neck of the thigh-bone, which had been mistaken for a dislocation, and the patient exposed, through the surgeon's ignorance, to a violent and protracted extension. It is therefore proper, that the form of the extremities of the bones, their mode of articulation, the ligaments by which they are connected, and the direction in which their most powerful muscles act, should be well understood.

Knowledge
of anatomy
necessary.

Yet it would be an injustice not to acknowledge, that the tumefaction arising from extravasation of blood, and the tension resulting from the inflammation, which frequently ensues, will, in the early days of the accident, render it difficult for the best surgeon perfectly to ascertain the exact extent of the injury; and, therefore, conclusions drawn at a time when the muscles are wasted, and the swelling is dispersed, when the head of the bone can be distinctly felt, and the motions of the limb are found to be impeded in a particular direction,—if they tend to the prejudice of

Difficult some-
times to detect
from tumefac-
tion.

the individual who may have given a different opinion under circumstances so much less favourable for forming a correct conclusion, will be both illiberal and unjust.

Symptoms.

The immediate effect of dislocation is to change the form of the joint, and often to produce an alteration in the length of the limb; to occasion the almost entire loss of motion in the part after the muscles have had time to contract, and to alter the axis of the limb. This altered position of the limb has been attributed, by some surgeons, to the influence of the remaining portion of ligament; but in every accident, the direction of the bone is too much the same to induce the belief that it is chiefly the effect of muscular influence; for the ligament is extensively torn, in most cases scarcely any portion of it remaining whole, particularly in dislocations of the thigh, yet the position of the limb under the different species of dislocation, is found subject to little variation. The form of the bone has, however, some influence on its future position: for in fractures of the neck of the thigh-bone, the knee is turned outwards; while in dislocations, it is turned inwards: a difference which arises from the greater capacity of the bone to roll upon its axis when the neck is broken.

At first much motion.

In the first moments, however, of the dislocation, considerable motion remains, and the position is not so determinately fixed as it afterwards becomes; for I have seen a man brought into Guy's Hospital, who, but a few moments before, had the thigh-bone dislocated into the foramen ovale, and I was surprised to find in a case otherwise so well marked, that a great mobility of the bone still existed at the dislocated part; but in less than three hours, it became firmly fixed in its new situation by the permanent, or, as it is called, *tonic* contraction of the muscles.

Length of limb altered.

In some dislocations the limb is rendered shorter, and thus the muscles influenced by it are immediately thrown into a state of relaxation; but if the limb be elongated, the tension of the principal muscles around the joint is extreme, and they are sometimes stretched to laceration. Blood is often effused in considerable quantity around the joint, which renders detec-

Effusion of blood.

tion of the accident difficult; the swelling being sometimes so considerable as to conceal entirely the ends of the bones. This effusion is in proportion to the size and number of the vessels lacerated.

A severe but obtuse pain arises from the pressure of the head of the bone upon the muscles, and, in some cases, this pain is rendered more acute from its pressure upon a large nerve. From this cause also is produced a paralysis of the parts below, instances of which occur in dislocations of the shoulder. In other cases, the bone presses upon important parts so as to produce effects dangerous to life. I have for many years mentioned in my lectures, a case of dislocated clavicle pressing upon the œsophagus so as to endanger life; of which Mr. Davie, of Bungay, was so kind as to send me an account. A more detailed account of this case will be given hereafter.

Effects of pressure from the dislocated bone.

In most dislocations, the head of the bone may be readily felt in its new situation; and the rotation of the limb best discovers the nature of the accident, as by this movement, the head of the bone is found to roll. The natural prominences of the dislocated bone, in some instances, either disappear, or become less conspicuous,—as the trochanter in luxations of the hip-joint; but the contrary result ensues in dislocations of the elbow; for there the olecranon is more than usually prominent, and serves as the principal guide for discovering the nature of the injury.

Criterion of the accident by rotation.

The more remote effects of the accident are, that frequently a sensation of crepitus is produced by the effusion of adhesive matter (*fibrin*) into the joint and bursæ; the synovia becomes inspissated, and crackles under motion,—a circumstance of which every practitioner should be aware, as he may be otherwise induced erroneously to suspect the existence of fracture.

Crepitus.

The degree of inflammation which succeeds to these accidents, is generally slight; but in some cases it becomes so considerable as to produce a tumefaction, which, added to that resulting from

Inflammation and suppuration.

extravasation of blood, frequently renders the detection of the injury exceedingly difficult. Sometimes, after the reduction of dislocations, suppuration ensues, and the patient falls a victim to excessive discharge and irritation. Mr. Howden, who was one of our most intelligent apprentices at Guy's Hospital, and was afterwards surgeon in the army, related the following case :—"A man had his thigh dislocated upwards and backwards on the ilium, which was soon after reduced; the next day a considerable swelling was observed on the part, which continued to increase, accompanied with rigours, and in four days the patient died. On dissection, the capsular ligaments, and ligamentum teres, were found entirely torn away, and a considerable quantity of pus extravasated in the surrounding parts." I attended the master of a ship, who had dislocated his thigh upwards; an extension was made, apparently with success; but in a few days a large abscess formed on the thigh, which destroyed the patient. Fortunately, however, such a result is by no means common.

When, from length of time, or any other cause, the reduction of the limb is rendered impracticable, the bone forms for itself a new bed, and some degree of motion is gradually recovered; although in neglected dislocations of the lower extremity, the patient is ever after lame; and in those of the upper, the motion and power of the limb are very much diminished.

Appearances on
dissection.

Ligaments.

On examination of the bodies of persons who die in consequence of dislocations arising from violence, the head of the bone is found completely removed from its socket. The capsular ligament is torn transversely to a great extent; the peculiar ligaments of joints, as the ligamentum teres of the hip, are torn through: but the tendon of the biceps, in dislocation of the os humeri, remains uninjured, as far as I have been able to ascertain by dissection; although I would by no means be understood to say that this is universally the case.

Tendons.

The tendons which cover the ligaments are also torn; as the tendon of the subscapularis muscle, in the dislocation in the axilla; and according to the extent of this laceration, is the

facility with which the accident recurs after reduction,—a circumstance frequently very difficult to obviate.

The muscles are also influenced by the nature of the accident, being in some cases put upon the stretch, even to laceration; as the pectineus and abductor brevis, in dislocations of the thigh downward; and large quantities of blood become extravasated into the cellular membrane.

The appearance of joints which have long been dislocated, depends not only on the length of time that has elapsed from the accident, but also on the structure upon which the head of the dislocated bone is thrown; for if it be found embedded in muscle, its articular cartilage remains, and a new capsular ligament forms around it, which does not adhere to its cartilaginous surface. This ligament in dislocations of the femur, contains within it the head of the bone, with the lacerated portion of the ligamentum teres united to it. In these instances, the bones themselves undergo little change. The capsular ligament is formed from the surrounding cellular tissue; which, being pressed upon by the head of the bone, becomes inflamed, thickened, and condensed. By this means a substance is produced somewhat less dense than original ligament, but still possessing sufficient firmness to bear considerable pressure, and to furnish some degree of support.

But if the head of the dislocated bone be placed on the surface of another bone, or upon a thin muscle over it, that muscle becomes absorbed, and the bone undergoes a remarkable change: thus it is found, if the dislocation be not reduced, that both the ball and the bone which receives it are changed in their form. The pressure of the head of the bone produces absorption of the periosteum, and of the articular cartilaginous surface of the head of the bone; a smooth hollow surface is formed, and the ball becomes altered in its shape to adapt it to its new surface; and whilst this absorption proceeds upon the part on which the head of the bone rests, an ossific deposit takes place around it from the periosteum, which is there irritated, but not absorbed.

Muscles.

Dissections of
old dislocations.

Head of the
bone embedded
in muscle.

Formation of a
new capsular
ligament.

Manner of its
formation.

Head of the
bone resting on
another bone.

Formation of a
new socket.

By the deposition of this bony matter between the periosteum and the original bone, a deep cup is formed to receive the head of the bone; and perhaps no instances can be adduced which more strongly mark the powers of nature in changing the form of parts to accommodate them to new circumstances, than these effects of dislocation.

The new cup which is thus formed, sometimes so completely surrounds the neck of the bone, as to prevent its being separated without fracture; and the socket is smoothed upon its internal surface, so as to leave no projecting parts which can interrupt the motion of the bone in its new situation.

The muscles losing their action, become diminished in bulk, and reduced in their length, in proportion to the displacement of the bone towards their origin; and if the dislocation has been long unreduced, they lose their flexibility, and tear rather than yield to extension.

Dislocation from
relaxation.

Although dislocations happening from violence are accompanied by laceration of the ligaments of the joint, yet they may occur from relaxation of the ligaments only, of which the following case is an example.

Case.

A girl came to my house who had the power of throwing her patellæ from the surfaces of the condyles of the os femoris. Her knees were bent considerably inwards; and when the rectus muscle acted upon the patella, it was drawn from the thigh-bone into a line with the tubercle of the tibia, and laid nearly flat upon the side of the external condyle of the femur. She came from the south of Europe, where she had been brought up as a dancing girl from her earliest years, gaining her daily bread, as we see children in the streets of London, by dancing upon elevated platforms; and she imputed to these continued and early exertions the weakness under which she laboured.

Dislocation
from accumula-
tion of synovia.

A similar relaxation of ligaments, is also produced by an accumulation of synovia in joints. Mr. Shillito, surgeon at Hertford, requested me to see a female domestic belonging to a family in my

neighbourhood, who had a great enlargement of the knee-joint from an inordinate secretion of synovia; and when this became absorbed, the ligaments remained so much relaxed, that the efforts of the muscles in walking dislocated the patella outwards. I ordered her into the hospital, that the students might observe this case, of which the following is an account.

Ann Parish was admitted into Guy's Hospital in the autumn of 1810, for a dislocation of the left patella from relaxation of the ligaments. She had for four years previously a large accumulation of synovia in that knee, causing some pain and much inconvenience in walking. Blisters had been applied without much effect, and other means tried for four months before her admission. When the knee had acquired considerable size, the swelling spontaneously subsided, and she then first discovered that the patella became dislocated when she extended the limb. She suffered some pain whenever this happened, and she lost the power of the limb in walking, so that she fell when the patella slipped from its place, which it did whenever she attempted to walk without a bandage. The patella was placed upon the external condyle of the os femoris, when thrown from its natural situation, to which it did not return without considerable pressure of the hand. In other respects, her health was good. Straps of adhesive plaster were ordered to be applied, and a roller to be worn, which succeeded in preventing the dislocation so long as they were used; but the bone again slipped from its place whenever they were removed. A knee-cap, made to lace over the joint, was ordered for her.

Cases of dislocation from relaxation.

Dislocation sometimes arises from a loss of muscular power; for when the muscles are kept long and forcibly extended, their tone becomes destroyed; or if, from a paralytic affection, they lose their action, a bone may be dislocated easily, but it is as readily replaced: of the first of these two causes, the following case is an illustration.

Paralysis.

Mr. —, a gentleman who had passed some of his early life in the East Indies, happened, as a junior officer on board his ship, to

Case.

be placed under the orders of one of the mates when the captain was on shore; and for some trifling offence was punished in the following manner:—His foot was placed upon a small projection on the deck, and his arm was lashed tightly towards the yard of the ship, and thus kept extended for an hour. When he returned to England, he had the power of readily throwing that arm from its socket merely by raising it towards his head, but a very slight extension reduced it; the muscles were also wasted, as in a case of paralysis.

I have also seen in a dislocation of the thumb, the first phalanx capable of being thrown from the os metacarpi pollicis, merely by the action of the muscles, from a relaxed state of the ligament.

Of the influence of paralysis, the following case is an example.

Case.

I was desired to see a young gentleman, who had one of those paralytic affections in his right side, which frequently arise during dentition. The muscles of the shoulder were wasted; and he had the power of throwing his os humeri over the posterior edge of the glenoid cavity of the scapula, from whence it was easily to be reduced.

In these cases, particularly in the latter, no laceration of the ligaments could have occurred; and they shew the influence of the muscles in preventing dislocation from violence, and in impeding its reduction.

Dislocation
from ulceration.

Dislocations arise from ulceration, by which the ligaments are detached, and the bones become altered in their form. We frequently find this state of parts in the hip-joint; the ligaments ulcerated, the edge of the acetabulum absorbed, the head of the thigh-bone changed both in its magnitude and figure, escaping from the acetabulum upon the ilium, and there forming for itself a new socket. There is in the anatomical collection at St. Thomas's Hospital, a preparation of the knee dislocated by ulceration, ankylosed at right angles with the femur, and the tibia turned directly forwards. A boy, in Guy's Hospital, had his knee dislocated by ulceration, with the tibia thrown on the inner

side of the external condyle of the os femoris; and a girl, in the same hospital, had the knee dislocated by ulceration, the head of the tibia being placed behind the condyles of the os femoris.

Dislocations are sometimes accompanied with fracture. At the ankle-joint, it rarely happens that dislocation occurs without a fracture of the fibula; and at the hip-joint, the acetabulum is occasionally broken. Fractures and dislocations.

Dislocations of the os humeri, are also accompanied sometimes with fracture of the head of that bone; of which there is a specimen in the Museum of St. Thomas's Hospital. The coronoid process is occasionally broken in dislocations of the ulna, producing a species of luxation, which does not permit the bone to be afterwards preserved in its natural situation.

When a bone is both broken and dislocated, it is proper to endeavour to reduce the dislocation without loss of time, taking care that the fractured part be strongly bandaged in splints, to prevent any injury to the muscles; for if this be not done at first, it cannot be afterwards effected without danger of re-producing the fracture. Dislocation and fracture.

If a compound fracture of the leg, and a dislocation of the shoulder happen in an individual at the same time, the reduction of the arm should be immediately undertaken, after the fractured limb has been secured in splints. The Rev. Mr. H——, from the accident of being thrown from his chaise, had a compound fracture of the leg, and a dislocation of the shoulder forwards. The dislocation was not at first observed, nor was its reduction attempted till a fortnight had elapsed. The trial, however, proved unsuccessful; for, from a dread of fever and injury to the leg, sufficient extension could not be used.

The accidents which have been called dislocations of the spine, are generally fractures of the vertebræ, followed by displacement of the bones, but not of the intervertebral substance: even the articulatory processes are broken, as well as the bodies of the vertebræ; so that they are not true dislocations of the spine, ex-

cepting those of the upper cervical vertebræ,—dislocations of which are said to have occasionally occurred. The injuries of the spine, which produce paralysis of the lower extremities, arise from fractured portions of the bodies of the vertebræ pressing upon, and sometimes lacerating, the medulla spinalis.

Compound dislocations.

In *compound dislocation*, not only the articulatory surfaces of the bone are displaced, but the cavity of the joint is laid open by a division of the skin and the capsular ligament. The immediate effect of compound dislocation is to occasion the extravasation of blood into the joint, and to allow the escape of the synovia.

Danger.

Compound dislocations are attended with great danger, and for the following reason:—

When a joint is opened, inflammation of the lacerated ligaments and synovial surface speedily succeeds; in a few hours suppuration begins, and granulations arise from the surface of the secreting membrane; which, being of the mucous kind, is more disposed to the suppurative, than to the adhesive inflammation. But the same process does not immediately ensue upon the extremity of the bone, because it is covered by the articular cartilage. This cartilage, before the cavity fills with granulations, becomes absorbed, by an ulcerative process instituted on the ends of the bones, but sometimes beginning from the synovial surface. The bone inflames, the cartilage becomes ulcerated, numerous abscesses are formed in different parts of the joint, and at length granulations spring from the extremities of the bones deprived of their cartilages, and fill up the cavity; generally these granulations become ossified, and ankylosis succeeds; but sometimes they remain of a softer texture, and some degree of motion in the joint is gradually regained.

This process of filling up joints requires great general as well as local efforts; a high degree of irritation is produced, and if the constitution be weak, the patient, to preserve his life, is sometimes obliged to submit to amputation.

Injury to muscles, blood-vessels, &c.

In addition to the above, in compound dislocations the violence necessarily inflicted on the parts, the injury of the muscles and

tendons, and the laceration of blood-vessels, necessarily lead to more important and dangerous consequences than those which follow simple dislocations.

With respect to the treatment of compound dislocations, I propose to reserve my remarks for that part of the work which relates to injuries of the ankle, where such observations will be required, and where they will be better understood; and thus a repetition, superfluous, and perhaps irksome, will be avoided. I shall just remark, that some joints are more liable to compound dislocations than others. The hip-joint is scarcely ever so dislocated; of the shoulder I have known two instances; but the elbow, wrist, ankle, and fingers, are frequently the seats of this accident; and I have seen an instance of it in the knee. Treatment.

In consequence of their different formation, we find that in some joints dislocation is much more frequent than in others. Those which have naturally extensive motions are easily luxated, and hence the dislocation of the os humeri occurs much more frequently than that of any other bone; and having once occurred, it happens again readily in the mere natural elevation of the arm. It is wisely ordained that, in those parts to which extensive motion is assigned, and for which great strength is required, there is a multiplicity of joints. Thus, in the spine, in which great strength is necessary to protect the spinal marrow, numerous joints are formed; and the motion between any two of the bones is so small, that dislocations, except between the first and second vertebræ, rarely occur, although the bones are often displaced by fracture. Some joints more easily dislocated than others.

The carpus and the tarsus are constituted on a similar principle; they allow of considerable motion, yet maintain great strength of union. For if the motion between two bones, as in the spine, be multiplied by twenty-four, and that at the carpus by eight, the result will shew that great latitude of motion is given, and the strength of the part preserved; whilst, if the spine had been formed of a single joint, dislocations might have easily happened, and death from this cause have been a frequent occurrence.

Partial dislocations.	Dislocations are not always complete, since bones are sometimes but partially thrown from the articulatory surface on which they rested; this species of dislocation now and then occurs at the ankle-joint. An ankle which was dissected at Guy's Hospital by Mr. Tyrrell, and afterwards given to the Museum at St. Thomas's was found partially dislocated; the end of the tibia still rested in part upon the astragalus, but a larger portion of its surface rested on the os naviculare; and the tibia, altered by this change of place, had formed two new articulatory surfaces, with their faces turned in opposite directions towards the two tarsal bones. The dislocation had not been reduced. The knee-joint is, I believe, rarely dislocated laterally in any other way; for its extensive articular surfaces almost preclude the possibility of complete displacement. The os humeri sometimes rests upon the edge of the glenoid cavity, and readily returns into its socket; and the elbow-joint is dislocated partially, both in relation to the ulna and the radius.
Instance.	The lower jaw is also sometimes partially dislocated, but in a different manner; one of the joints being luxated, and the other remaining in its place.
Cause.	Dislocations are generally occasioned by violence, and the displacing force usually takes effect whilst the bone is in an oblique direction to its socket; but the muscles must necessarily have been in a great degree unprepared for resistance, otherwise the greatest force would hardly have produced the effect: when they are unprepared, the injury will often ensue from very slight accidents. A fall in walking will sometimes dislocate the hip-joint, when the muscles have been prepared for a different exertion.
Resistance of muscles.	While dwelling on this subject in my lectures, I have usually adverted to the execution of Damien, as illustrative of this position. Damien was executed for the attempt to murder Lewis XV. Four young horses were attached to his legs and arms, and were forced to make repeated efforts to tear his limbs from his body, but could not effect this purpose; and after fifty minutes, the executioners were obliged to cut the muscles and ligaments to effect

his dismemberment; or, in homelier phrase, to hew him limb from limb.

The following is the French account of this execution.

“ Il arriva à la place de Grève à trois heures et un quart, regardant d'un œil sec et ferme le lieu, et les instrumens de son supplice. On lui brula d'abord la main droite; ensuite on le tenailla, et on versa, sur ses plaies, de l'huile, du plomb fondu, et de la poix-resine. On procéda ensuite à l'écartellement. Les quatre chevaux firent pendant cinquante minutes des efforts inutiles pour demembrer ce monstre. Au bout de ce tems là, Damien, étant encore plein de vie, les bourreaux lui couperent avec de bistouris, les chairs et les jointures nerveuses des cuisses, et de bras; ce qu'on avoit été obligé de faire en 1610 pour Ravallac. Il respiroit encore après que les cuisses furent coupées, et il ne rendit l'ame que pendant qu'on lui coupoit les bras. Son supplice depuis l'instant qu'il fut mis sur l'échafaud, jusqu'au moment de sa mort, dura près d'une heure et demie. Il conserva tout sa connoissance, et releva sa tête sept ou huit fois, pour regarder les chevaux, et ses membres ténaillés et brulés. Au milieu des tormens les plus affreux de la question il avoit laissé échapper des plaisanteries.”—

Execution of
Damien.

Dictionnaire Historique.

Old persons are much less liable to dislocations than those of middle life, because the extremities of bones in advanced age are often so soft as to break under the force applied, rather than quit their natural situations. Persons of lax fibre are prone to dislocation, because their ligaments easily tear, and their muscles possess little power of resistance. From these circumstances old people would be exposed to frequent dislocations, but for the softened state of the extremities of their bones.

Dislocations
rare in old age.

Young persons are also very rarely the subjects of dislocations from violence; but now and then such accidents do occur: and I have described an instance of them in a child at seven years of age. It generally happens that their bones break, or their epiphyses give way, rather than that the parts suffer displacement. I read of dislocations of the hip in children, but their history is that of

Dislocations
rare in the
young.

diseases of the hip-joint, in which the dislocation has arisen from ulceration.

A child was brought to me from one of the counties north of London, for whom repeated extensions had been made by one of those people called *bone-setters*,—but who ought rather to be called *dislocators*,—for a supposed dislocation of the hip-joint. Upon examination, I found it to be that disease of the hip so common in children: and for this only, was a child wantonly exposed to a most painful extension.—That in this enlightened country, men, without education, should be suffered with impunity to degrade a most useful profession, and torture those who have the folly or the simplicity to apply to them, is a disgrace to our laws, that calls loudly for prevention.

Elbow-joint dislocations.

Dislocations of the elbow-joint in children are said to be of frequent occurrence. Surgeons have been heard to say, “I have a child under my care with luxation of its elbow, and I can easily return the bone into its place, but it directly dislocates again.” Such a case is, in reality, an oblique fracture of the condyles of the os humeri, which produces the appearance of dislocation, by allowing the radius and ulna, or the ulna alone, to be drawn back with the fractured condyle, so as to produce considerable projection at the posterior part of the joint.

TREATMENT.

Difficulty of reduction.

The reduction of dislocations is often difficult; and in some of the joints, the form of the bone may occasion impediments. Thus, when the socket is surrounded by a lip of bone, as in the hip-joint, the head of the bone, during the act of reduction, stops at this projection, and requires to be lifted over it; another difficulty occurs when the head of the bone is much larger than its cervix; as for example, in the dislocation of the head of the radius; but still these causes are slight in comparison with others which we have to detail.

Capsular ligaments.

The capsular ligaments are by some supposed to resist reduc-

tion ; but those who entertain this opinion must forget their inelastic structure, and cannot have had opportunities of witnessing by dissection, the extensive laceration which they sustain in dislocations from violence. The capsular ligaments, in truth, possess but little strength either to prevent dislocation, or to resist the means of reduction ; and if the tendons with which they are covered, and the peculiar ligaments of the joints did not exist, dislocation must be of very frequent occurrence.

The joint of the shoulder, and those of the knee and elbow, are strongly protected by tendons ; the shoulder by those of the spinati, subscapularis and teres minor muscles ; the elbow by the triceps and brachialis ; the knee by the tendinous expansion of the vasti : but still some ligaments resist dislocations : these, however, are the peculiar, not the capsular ligaments. The wrist and the elbow have their appropriate lateral ligaments to give additional strength to these joints. The shoulder, instead of a peculiar ligament, has the tendon of the biceps received into it, which lessens the tendency to dislocation forwards ; the ligamentum teres of the hip-joint prevents facility of dislocation downwards ; the knee has its lateral and crucial ligaments ; and the ankle, exposed as it is to the most severe injuries, is provided with its deltoid and fibular tarsal ligaments, of very extraordinary strength, to prevent dislocation. The bones of this joint often break rather than their ligaments give way ; however, in many of the joints, as these ligaments are torn, they afford no resistance to the reduction of dislocations, as in the hip, elbow, and wrist ; but if one of them remain, it produces difficulty in the reduction, as I have seen in the knee-joint.

Tendons.

Peculiar ligaments.

The difficulty of reducing dislocations arises principally from the resistance which the muscles present by their contraction, and which is proportioned to the length of time which has elapsed from the injury ; it is therefore desirable that the attempt at reduction should not be long delayed.

Muscles.

The common action of the muscles, are voluntary or involun-

tary ; but they have a power of contraction independent of either state.

Fatigue of muscles.

A muscle, when excited to action by volition, soon becomes fatigued, and requires rest. The arm can be extended only for a few minutes, at right angles with the body, before it feels a fatigue which requires a suspension of action ; and, indeed, the same law governs involuntary action, as the heart has its contraction and relaxation.

Permanent contraction.

But when a muscle is divided, its parts contract ; or when the antagonist muscle is cut, the undivided muscle draws the parts into which it is inserted, into a fixed situation. Thus, if the biceps muscle be divided, the triceps keeps the arm constantly extended ; if the muscles on one side of the face be paralytic, the opposing muscles draw the face to their side. This contraction is not succeeded by fatigue or relaxation, but will continue an indefinite time, even until the structure of the muscle becomes changed ; and its contraction increases from the first occurrence of the accident. Thus it is, that when a bone is dislocated, the muscles draw it as far from the joints as the surrounding parts will allow, and there retain it by their contraction. It is this resistance from muscles, aided by their spontaneous contraction, which the surgeon is required to counteract. If an extension be made almost immediately after a dislocation has happened, the resistance produced by the muscles is easily overcome : but if the operation be postponed for a few days only, the utmost difficulty occurs in its accomplishment.

Vis tonica of muscles.

Mr. Forster, son of the surgeon of Guy's Hospital, informed me that in a fatal case of fracture of the thigh-bone, which he had an opportunity of dissecting before its union, the ends of the bones overlapped, and the muscles had acquired a contraction so rigid, that he could not, even in the dead body, bring the bones to their natural position, after employing all the force he was capable of exerting. It is this state of muscles in dislocations, which gives rise to the difficulty in their reduction, and which, even in the

dead body, is still capable of opposing a very considerable resistance.

That the muscles are the chief cause of resistance, is strongly evinced by those cases in which the dislocation is accompanied by injury to any vital organ, and when the power of muscular action is diminished; for it is then found, that a very slight force is sufficient to return the bone to its situation. Thus, in the case already mentioned, of the man who had an injury to his jejunum, and a dislocation of his hip, the bone was reduced with little difficulty.

When a dislocation has long existed, difficulties arise from three other circumstances. The extremity of the bone becomes united to the surrounding parts, by adhesive matter, so that even when in dissection the muscles are removed, the bone cannot be reduced. In this state I found the head of a radius, which had been long dislocated, resting upon the external condyle of the os humeri, and which is preserved in the collection at St. Thomas's Hospital; and in a similar state I have seen the os humeri when dislocated. The socket is also sometimes so filled with adhesive matter, that if the bone were reduced, it could not remain in its original situation, and the original cavity is in part filled with ossific matter, so as to render it incapable of receiving the head of the bone. Lastly: a new bony socket is sometimes formed, in which the head of the bone is so completely confined, that nothing but its fracture will allow it to escape from its new situation.

Other difficulties.

The means to be employed for the reduction of dislocations, are both constitutional and mechanical; force alone is in general objectionable, since it would be required in so great a degree as to occasion violence and injury; and it will in the sequel be shewn, that the most powerful mechanical means fail when unaided by constitutional remedies. The power and direction of the larger muscles are, in the first instance, to be duly appreciated, as these form the principal causes of resistance.

Means of reduction.

The constitutional expedients applicable for the purpose of reduction, are those which produce a tendency to syncope, and this necessary state may be best induced by one or other of the fol-

Constitutional.

lowing means: viz., *bleeding*, *warm-bath*, and *nausea*. Of these remedies, I consider bleeding the most powerful; and, that the effect may be produced as quickly as possible, the blood should be drawn from a large orifice, and the patient kept in the erect position, for by this mode of depletion, syncope is produced before too large a quantity of blood is lost. However, the activity of this practice must be regulated by the constitution of the patient; if he be young, athletic, and muscular, the quantity removed should be considerable, and the method of taking it away should be that which I have described.

The warm bath. In those cases in which the warm-bath may be thought preferable, or where it may be considered improper to continue the bleeding, the bath should be employed at the temperature of 100° to 110°; and, as the object is the same as in bleeding, the person should be kept in the bath at the same heat till the fainting effect is produced, when he should be immediately placed in a chair, wrapped in a blanket, and the mechanical means employed which I shall hereafter particularly describe.

Antim. Tart. Of late years, I have practised the mode of lowering the action of the muscles, by exhibiting nauseating doses of tartarized antimony; but as its action is uncertain, frequently producing vomiting, which is unnecessary, I rather recommend its application merely to such extent as to keep up the state of syncope already produced by the two preceding means; this its nauseating tendency will most readily effect, and so powerfully overcome the tone of the muscles, that dislocations may be reduced with much less effort, and at a much more distant period from the accident, by these means, than in any other way.

Combination of remedies. The two cases related in the follow pages, one from Mr. Norwood, surgeon at Hertford, and the other from Mr. Thomas, apothecary to St. Luke's Hospital, will illustrate the efficacy of the treatment recommended. By the combination of bleeding, the warm-bath, and nauseating doses of tartarized antimony, two dislocations were reduced at a more distant period from the accident than I have ever known in any other example. One of these

cases occurred at Guy's, and the other at St. Thomas's Hospital, at the time when these gentlemen were officiating as dressers.

The effect of opium I have never tried, but it would probably be useful in a large dose, from its power of diminishing muscular and nervous influence. Opium.

The reduction of the bone is to be attempted, after lessening the power of the muscles, by fixing one bone, and drawing the other towards its socket. It is now generally agreed among the most eminent surgeons, that force should be only gradually applied; for violence is as likely to tear sound parts, as to reduce those which are luxated; and it is apt to excite all the powers of resistance to oppose the efforts of the surgeon. Hence it becomes necessary to produce, gradually, that state of fatigue and relaxation which is sure to follow continued extension, and not to attempt at once to overpower the action of the muscles. Mechanical means.

One great cause of failure in the attempt to reduce dislocations, arises from insufficient attention to the fixation of that bone in which the socket is placed. For example: in attempting to reduce a dislocation of the shoulder, if the scapula be not fixed, or if one person pull at the scapula and two at the arm, the scapula will be necessarily drawn with the os humeri, and the extension will be very imperfectly made; the one bone, therefore, must be firmly fixed, or drawn in the opposite direction, while the other is extended. Cause of failure.

The force required may be applied either by the exertion of assistants, or by a compound pulley; but the object is to extend the muscles by gradual, regular, and continued efforts; in cases of difficulty recourse should always be had to the pulley; its effect may be gentle, continued, and directed by the surgeon's mind; but when assistants are employed, their exertions are sudden, violent, and often ill directed; and the force is more likely to produce laceration of parts, than to restore the bone to its situation. Their efforts are also frequently uncombined, and their muscles as necessarily become fatigued as those of the patient, whose resistance they are employed to subdue. Compound pulley.

In dislocation of the hip-joint, pulleys should always be employed; and in those dislocations of the shoulder, which have long remained unreduced, they should also be resorted to. I do not mean to doubt the possibility of reducing dislocations of the hip by the aid of men only, but to point out the inferiority of this mode to the mechanical means. The employment of pulleys in dislocations, is not a modern practice: Ambrose Paré frequently had recourse to them, and good practical surgeons have used them since his time:—most writers on surgery have also mentioned their use, but they have not duly appreciated them. Mr. Cline, whose professional judgment every one must acknowledge, always strongly recommended them.

Relaxation of the stronger muscles.

During the attempt to reduce luxations, the surgeon should endeavour to obtain a relaxation of the stronger opposing muscles. The limb should therefore be kept in a position between flexion and extension, as nearly as that medium can be obtained. Who has not seen, in the attempt to reduce a compound fracture in the extended position of a limb, the bone, which could not be brought into apposition under the most violent efforts, quickly replaced by an intelligent surgeon, who has directed the limb to be bent, and the muscles to be placed in a comparative state of relaxation?

Whether the extension should be applied to the dislocated bone.

A difference of opinion prevails, whether it is best to apply the extension on the dislocated bone, or on the limb below. M. Boyer, who has long taken the lead in surgery in Paris, prefers the latter mode. As far as I have had an opportunity of observing, it is generally best to apply the extension to the bone which is dislocated. There are, however, exceptions to this rule in the dislocation of the shoulder, which I generally reduce by placing the heel in the axilla, and by drawing the arm at the wrist in a line with the side of the body.

Influence of the mind.

In the reduction of dislocations, great advantage is derived from attending to the patient's mind; the muscles opposing the efforts of the surgeon, by acting in obedience to the will, may be made to desist from that action by directing the mind to other muscles. Several years since, a surgeon in Blackfriars' Road, asked me to

see a patient with a dislocated shoulder, which had resisted the various attempts he had made at reduction. I found the patient in bed, with his right arm dislocated. Sitting down on the bed by his side, I placed my heel in the axilla, and drew the arm at the wrist; the dislocated bone remained unmoved. I said, "Rise from your bed, Sir:" he made an effort to do so, whilst I continued my extension, and the bone snapped into its socket. For a similar reason a slight effort, when the muscles are unprepared, will accomplish the reduction of dislocation, after violent measures have failed.

The reduction of the limb is ascertained by the restoration of its natural form, by the recovery of its original motion, and by a snap or sudden sound, which is heard when the bone returns into its articulatory cavity.

After a bone has been reduced by the pulleys, it will not remain in its situation without the aid of bandages to support it, until the recovery of muscular action. In the hip, however, dislocations rarely occur a second time; but the shoulder and the lower jaw very frequently slip again from their sockets, owing to the little depth of the cavity into which the head of the bone is received; and therefore they require bandages for a considerable period.

Second dislocation.

Rest is necessary for some time after the reduction of the limb, in order to produce a union of the ruptured ligament, which would be prevented by exercise. The strength of the muscles and ligaments may also be greatly promoted by affusion of cold water upon the limb, and by subsequent friction.

Rest of the limb.

I believe that much mischief is produced by attempts to reduce dislocations of long duration in very muscular persons. I have seen great contusion of the integuments, laceration and bruises of muscles, tension of nerves, inducing an insensibility and paralysis of the hand, occasioned by an abortive attempt to reduce a dislocation of the shoulder; so that the patient's condition has been rendered much worse than before. In such cases, even when the bone is replaced, it has often proved rather an evil than a benefit, from the violence of the extension.

Old dislocations not to be reduced.

In those instances in which the bone remains in the axilla, in dislocations of the shoulder, a serviceable limb, and very extensive motions of it, may be regained, although reduction has not been effected. Captain S——, who had dislocated his shoulder four years before, called to shew me how much motion he had recovered, although the arm still remained unreduced.

Time for attempting reduction.

I am of opinion, that three months after the accident for the shoulder, and eight weeks for the hip, may be fixed as the period at which it would be imprudent to make the attempt at reduction, except in persons of extremely relaxed fibre, or of advanced age. At the same time, I am fully aware, that the shoulder has been reduced at a more distant period than that which I have mentioned but, in most instances, the reduction has been attended with the results I have just been deprecating.

In cases of unreduced dislocation, the only course which the surgeon can adopt, after the inflammation which the injury produces has subsided, is, to advise motion of the limb, and friction of the injured part:—The former, to produce a new cavity for the head of the bone, to assist in forming a new ligament, and to restore action to muscles, which they would otherwise lose by repose;—the latter, to promote absorption, and to remove the swelling and adhesions which the accident has caused.

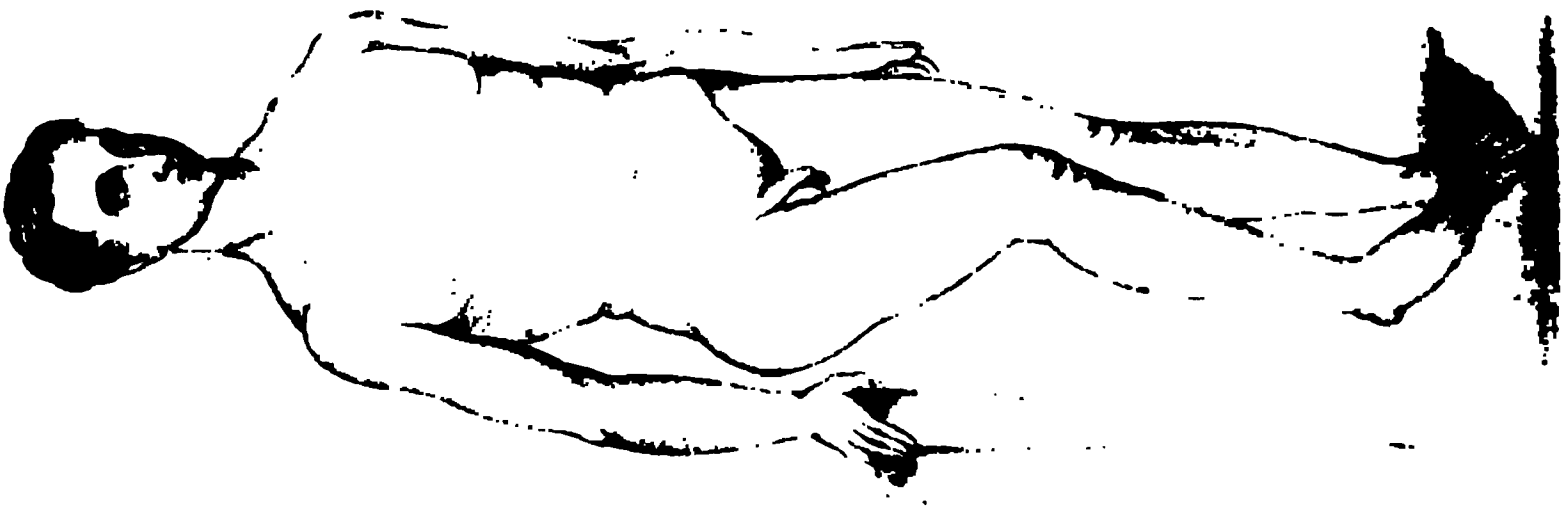
PARTICULAR DISLOCATIONS.

DISLOCATIONS OF THE HIP-JOINT.

Anatomy of the joint.

THE acetabulum of the hip-joint is deepened by a cartilaginous ridge, which surrounds its brim; and although in the skeleton it is not a complete cup, yet it is rendered such in the living subject, by

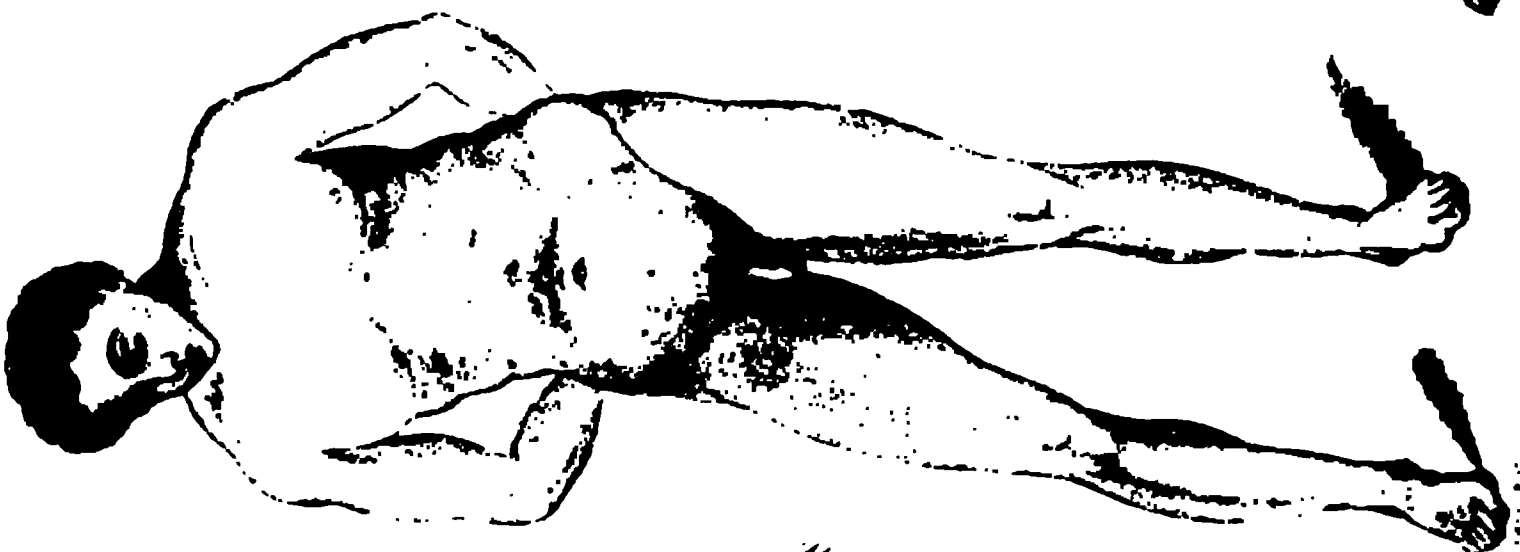
fig. 1



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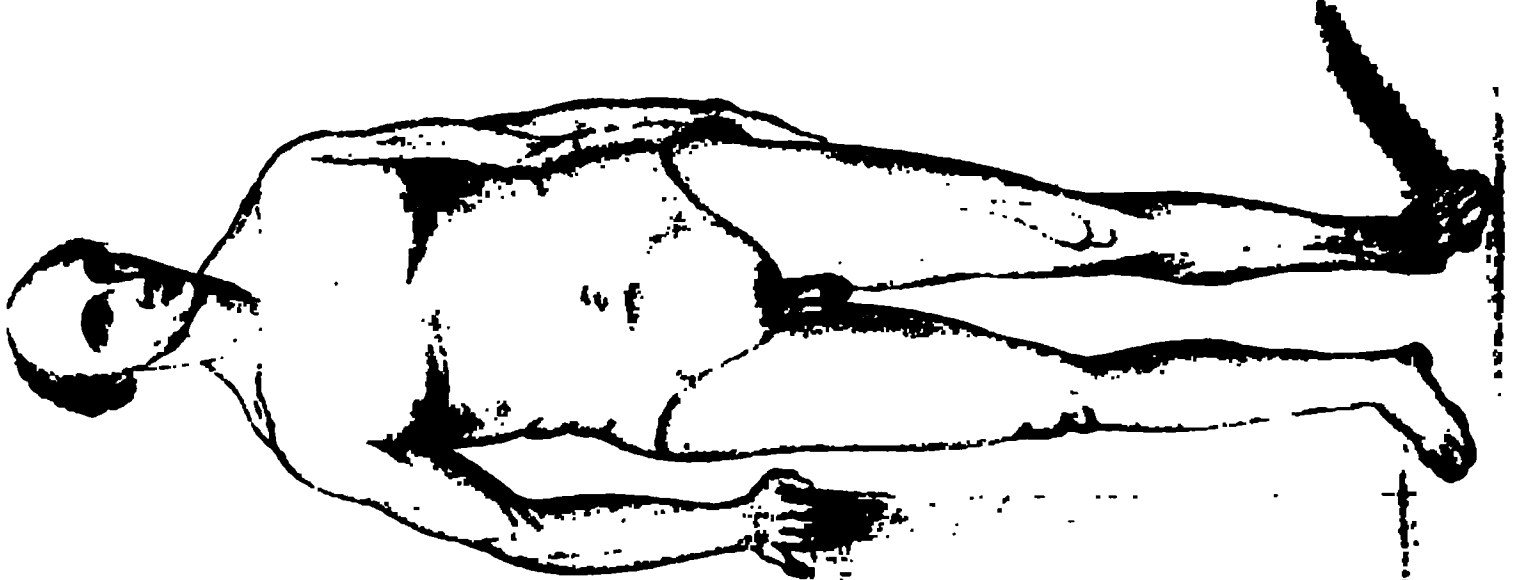


PLATE XI.

Shewing the positions of the limb in the different dislocations of the hip, and in the fracture of the cervix femoris.

Fig. 1. The dislocation upwards upon the dorsum ilii. The limb shortened—the hip projecting—the knee and foot turned inwards, with the toes resting over the metatarsus of the sound limb.

Fig. 2. The dislocation downwards into the foramen ovale. The limb lengthened—the knee advanced and separated from the other—the toes pointed—the heel does not touch the ground—the body bent forward.

Fig. 3. The dislocation into the ischiatic notch. The limb shortened—the knee and foot a little turned inwards, with the great toe resting against the ball of the great toe of the sound limb.

Fig. 4. The dislocation on the pubes. Projection at Poupert's ligament from the head of the bone, the limb widely separated from the other, and the knee and foot turned outwards—the limb a little shortened.

Fig. 5. Fracture of the cervix femoris. The leg is shorter, the knee turned out; the patella from one to two inches above the other; foot everted: the limb may be extended to the same length as the other, and then, if rotated, a crepitus will be felt.

an additional portion of cartilage, which fills up a depression in the bone in the inferior and anterior part of the cavity.

The ligaments are two: the capsular arises from the edge of the acetabulum, and passing over the head and neck of the bone, is inserted into the cervix of the os femoris at the root of the trochanter major. It is much more extensive on the anterior than on the posterior portion of the neck of the bone. The inner side of this ligament is a secreting surface, producing the synovia; and a reflected portion of it towards the head of the bone is also provided with a similar secreting surface. Ligaments.

On the anterior surface of the neck of the thigh-bone, the capsular ligament is received into a line, which extends from the trochanter major to the trochanter minor. The synovial secreting surface is reflected towards the head of the bone, and the ligament is reflected close on the neck of the bone, to form the periosteum; whilst its fibres are intersected with the common periosteum, below the insertion of the ligament, into the bone.

On the posterior surface, the capsular ligament is received upon the neck of the bone, nearly midway between the edge of the head of the bone and the trochanter major. The common periosteum on the neck of the bone incorporates with the reflected ligament to form the periosteum of the neck of the bone within the capsule*.

The ligamentum teres is contained within the capsular ligament, and proceeds from a depression in the lower and inner part of the acetabulum, to be fixed in a hollow upon the inner side of the thigh-bone: it has a tendency to prevent dislocations in all directions, but particularly the dislocation downwards; for when this dislocation occurs, the thighs are widely separated from each other, as in fencing; and the head of the thigh-bone would be in danger of slipping from its socket, were it not prevented by this liga-

* *Query.*—Can this ligamentous periosteum be one cause of a ligamentous union in fractures within the joints? I believe that when a union of the neck of the thigh-bone is met with, it must be in a case in which this ligamentous sheath of the cervix has not been torn.

ment:—an example of its use, which shews the principal reason of its formation.

Mode of dislocation.

The thigh-bone I have seen dislocated in four directions:—First, upwards, or upon the dorsum of the ilium; secondly, downwards, or into the foramen ovale; thirdly, backwards and upwards, or into the ischiatic notch; and, fourthly, forwards and upwards, or upon the body of the pubes. A dislocation downwards and backwards, has been described by some surgeons, who have had opportunities for observation; but I have to remark, that no dislocation of that description has occurred at St. Thomas's or Guy's Hospitals, within the last thirty years, or in my private practice; and although I would not deny the possibility of its occurrence, yet I am disposed to believe that some mistake has arisen upon this subject.

DISLOCATION UPWARDS, OR ON THE DORSUM ILII.

Dislocations on the dorsum ilii.

This dislocation is the most frequent of those which happen to the hip-joint: and the following are the signs of its existence.

Symptoms.

The dislocated limb is from one inch and a half to two inches and a half shorter than the other, as will be seen by comparing the malleoli interni, when the foot is bent at right angles with the leg. The toe rests upon the tarsus of the other foot; the knee and foot are turned inwards, and the knee is a little advanced upon the other. When the attempt is made to separate the leg from the other, it cannot be accomplished, for the limb is firmly fixed in its new situation, so far as regards its motion outwards; but the thigh can be slightly bent across the other. If the bone be not concealed by extravasation of blood, the head of the thigh-bone can be perceived during rotation of the knee inwards, moving upon the dorsum ilii; and the trochanter major advances towards its anterior and superior spinous process, so as to be felt much nearer to it than usual. The trochanter is less prominent than on the opposite side, for the neck of the bone and the trochanter rest in the line of the surface of the dorsum ilii; and upon a comparison of the two

ips, the roundness of the dislocated side will be found to have disappeared. A surgeon, when called to a severe and recent injury of the hip-joint, looks for difference in length, change of position upwards, diminution of motion, and decreased projection of the trochanter.

The accident with which the dislocation upwards is liable to be confounded is, the fracture of the neck of the thigh-bone within the capsular ligament. Yet the marks of distinction are, in general, sufficiently strong to be unequivocal to a person commonly attentive. In a fracture of the neck of the thigh-bone, the knee and foot are generally turned outwards; the trochanter is drawn upwards and backwards, resting upon the dorsum ilii; the thigh can be readily bent towards the abdomen, although with some pain; but above all, the limb, which is shortened according to the duration of the accident, from one to two inches, by the contraction of the muscles, can be made the length of the other by a slight extension: and when the extension is abandoned, the leg is again shortened. If the limb when drawn down be rotated, a crepitus can often be felt, which ceases to be perceived when rotation is performed under a shortened state of the limb. Fracture of the neck of the thigh-bone, within the capsular ligament, rarely occurs but in advanced age; and the most trifling accident is sufficient to produce it, in consequence of the interstitial absorption which this part of the bone undergoes at advanced periods of life. Fractures externally to the capsular ligament, occur at any age, and they are easily distinguished by the crepitus which attends them, if the limb be rotated and the trochanter compressed with the hand. The position is the same as in fractures within the ligament. Fractures of the neck of the thigh-bone are very frequent accidents when compared with dislocations.

Distinction from fracture of the neck of the femur.

Diseases of the hip-joint can scarcely ever be confounded with dislocations from violence, but by those who are ignorant of anatomy, and who are very superficial observers. The gradual progress of the symptoms, the pain in the knee, with the apparent elongation at first, and real shortening afterwards; the capacity

Diseases of the hip-joint.

for motion, yet the pain given under extremes of rotation, as well as of flexion and extension, are indications of difference which would strike the most careless observer. The consequences of a disease of this kind, when it has existed for a great length of time, are, ulceration of the ligaments, acetabulum, and head of the bone, which allow of such a change of situation of parts, as sometimes to give the limb the position of dislocation; but the history of the case at once explains to the medical attendant the nature of the disease.

Cause.

This dislocation may be caused by a fall when the knee and foot of the patient are turned inwards, or by a blow whilst the limb is in that position;—the head of the bone being thus displaced upwards, and turned backwards.

In the reduction of this dislocation, the following plan is to be adopted:—let the patient lose from twelve to twenty ounces of blood, or even more if he be a very strong man; then place him in a warm bath, at the heat of 100° , and gradually increase it to 110° , until he feels faint. During the time he is in the warm-bath, give him a grain of tartarized antimony every ten minutes, until he feels some nausea; then remove him from the bath, and put him in blankets; he is then to be placed between two strong posts, about ten feet asunder, in which two staples are fixed; or rings may be screwed into the floor, and the patient be laid upon it. My usual method is, to place him on a table covered with a thick blanket upon his back; then a strong girth is passed between his pudendum and thigh, and this is fixed to one of the staples. A wetted linen roller is tightly applied just above the knee, and upon this a leathern strap is buckled, having two straps with rings at right angles with the circular part. The knee is to be slightly bent, but not quite at a right angle, and brought across the other thigh a little above the knee of that limb. The pulleys are fixed in the other staple, and in the straps above the knee. The patient being thus adjusted, the surgeon slightly draws the string of the pulley; and when he sees that every part of the bandage is upon the stretch, and the patient begins to complain, he waits a little to

give the muscles time to become fatigued; he then draws again; and when the patient suffers much, again rests, until the muscles yield. Thus he gradually proceeds until he finds the head of the bone approach the acetabulum. When it reaches the lip of that cavity, he gives the pulley to an assistant, and desires him to preserve the same state of extension, and the surgeon then rotates the knee and foot gently, but not with a violence to excite opposition in the muscles, and in this act the bone slips into its place. In general, it does not return with a snap into the socket when the pulleys are employed, because the muscles are so much relaxed, that they retain not sufficient tone to act with violence; and the surgeon ascertains the reduction only by loosening the bandages, and comparing the length of the limbs.

It often happens that the bandages get loose before the extension is completed, an accident which should be carefully prevented by having them well secured at first; but if they require to be renewed, this should be expeditiously performed, to prevent the muscles having time to recover their tone.

It is sometimes necessary for the operator to lift the bone, by placing his arm under it near the joint, when there is difficulty in bringing over the lip of the acetabulum; or a napkin may be passed under the bone, as near the head as possible, and by its means an assistant may raise it. After the reduction, in consequence of the relaxed state of the muscles, great care is required in removing the patient to his bed.

I have seen reduction of the bone effected, even where the extension was not made in the best possible direction; for when the muscles have not had time to settle, they will allow the bone to be restored into its socket, even when extension is made in a direction not the most favourable for its reduction. I cannot by any means subscribe to the method adopted by the late Mr. Hey, although no person ever felt greater respect for his talents, more highly appreciated his acquirements, or is more disposed to pursue the study of the profession in the mode which he so successfully adopted. The direction which he gave to a limb, in the case

which he has represented of this accident, was one little calculated for success, in cases where the means were not used immediately after the injury had been sustained. But I state this with great deference, because I am not sure, that in all respects, I understand the description of the method which he adopted; nor do I think that I should be able, from that description, to be certain that I was pursuing the means by which he succeeded.

I may here observe, and I trust without ostentation, that the methods which I have recommended, are the result of considerable experience; that they have been successful in a great number of cases; and that they have very rarely failed, under the most disadvantageous circumstances. They may require a little variation, from some slight difference in the position, but this will only be an exception to a general rule, and will very rarely occur.

The following cases will serve as illustrations of the history and treatment of dislocations on the dorsum ilii; the first of them points out, in a striking manner, the evils that ensue when dislocation of the hip-joint remains unreduced, and the advantages arising from the use of pulleys in effecting its reduction. It shews also that such dislocation may happen in a strong healthy man, even after he has attained the age of sixty.

DISLOCATION ON THE DORSUM ILII.

Case.

James Ivory, aged sixty-two, of Pottensend, Herts, on the 7th of February, 1810, was working in a clay-pit, twenty-five feet below the surface of the earth, when a large quantity of clay fell in upon him, while he was in the act of stooping with his left knee bent rather behind the other; and he was, in this position, buried under the earth. Being soon removed from this perilous situation and carried home, a surgeon was sent for, who discovering the accident to be a dislocation, directly employed some men to extend the limb, whilst he attempted to push the head of the bone into the acetabulum; but all his efforts were unavailing, as, unfortunately

for the patient, pulleys were not employed. The appearance of the limb, after nine years have elapsed since the accident, are these:— the limb is three inches and a half shorter than the other, and he is obliged to wear a shoe with an additional sole of three inches on that side, which lessens, though it does not prevent his halt in walking. When he stands, the foot of the injured limb rests upon the other; the toes are turned inwards; and the knee, which is advanced upon the other, is also inverted, and rests upon the side of the patella of the sound limb, and upon the vastus internus muscle; it is also bent, and cannot be completely extended. The thigh, from the unemployed state of several of the muscles, is very much wasted; but the semi-tendinosus, semi-membranosus, and biceps, in consequence of the shortened state of the limb, form a considerable rounded projection on the back part of the thigh. The trochanter major is seven-eighths of an inch nearer to the spine of the ilium of the injured side than of the other. On viewing him behind, the trochanter major is seen projecting on the injured side much farther than on the other; the situation of the head of the bone on the dorsum ilii, is easily perceived; and when the limb is rotated inwards, it is still more obvious. The spinous processes of the ilia are of an equal height. In the sitting posture, the foot is turned very much inwards, and the knee is placed behind the other, whilst the toe only reaches the ground. If fatigued, he experiences pain in the opposite hip, and in the thigh of the injured limb. This unfortunate man finds it an arduous task to gain his bread by his labour, as he cannot stoop but with the greatest difficulty; for when he attempts to take anything from the ground, he bends the knee of the injured limb at right angles with the thigh, and throws it far back. He can now stand for a few seconds upon the dislocated limb, but it was twelve months before he could endure that posture. When in bed, he finds it painful to lie on the injured side. His hip, without any apparent cause, is much weaker at some times than at others. When sitting down to evacuate his fæces, he is obliged to support himself by resting the injured knee against the tendo achillis of

the other leg, placing his right hand on the ground. He now walks with two sticks: at first he employed crutches, and these he used for twelve months, after which he was enabled to trust to one crutch and a stick, until his limb acquired greater strength. In getting over a stile, he raises the injured limb two steps, and then turns over the sound limb; but this he cannot accomplish when the steps are far apart; and he is frequently obliged either to turn back, or to take a circuitous route. When lying with his face downwards, the dislocated hip projects very much. He sometimes falls in walking, and would very frequently fall, but that he takes extreme care, as the least check to his motion throws him down. The knee is bent, and the shortening of the limb partly originates in that circumstance.

The following cases were sent me by the gentlemen whose names are attached; they illustrate the method of reduction detailed in the preceding pages, and shew in strong colours the advantages to be derived from constitutional treatment, and the use of pulleys.

Case of dislocation on the dorsum ilii.

John Forster, aged twenty-two years, was admitted into the Chester Infirmary, July 10, 1818, with a dislocation of the thigh on the dorsum ilii, occasioned by a cart passing over the pelvis. Upon examination, I found the leg shorter than the other, and the knee and foot turned inwards. The patient being firmly confined upon a table, I extended the limb by pulleys for fifty minutes without success, and he was returned to bed for three hours; after which he was put in the warm bath for twenty minutes, and the extension was repeated for fifteen minutes unsuccessfully; I therefore took twenty-four ounces of blood from him, and gave him forty drops of tinct. opii. Continuing the extension, but not succeeding in producing faintness, I gave small doses of a solution of tartrate of antimony, which in quarter of an hour produced nausea: in ten minutes afterwards I succeeded in reducing the limb, and in less than a fortnight he left the Infirmary quite well.

S. R. BENNET.

Chester.

John Lee, aged thirty-three, of a strong and robust constitution, Case. in passing over a foot-bridge, October 9th, 1819, fell from a height of about four feet on a large stone, and dislocated his left hip. I did not see him until the fourth of December, when I found the limb full three inches shorter than the other, the knee turned in, the foot directed over the opposite tarsus, and the trochanter major brought nearer the spinous process of the ilium. On laying the man on his face, the head of the femur and trochanter could be distinctly seen on the dorsum ilii, so as to leave not the slightest doubt of the nature of the injury. With the assistance of a neighbouring practitioner, I immediately set about to reduce it. A girth was applied between the legs, and a bandage over the knee, to fix the pulleys, &c., in the usual manner. I then made the extension downwards and inwards, crossing the opposite thigh two-thirds downwards: and immediately when the extension was commenced, I gave him a solution of two grains of tartar emetic, which was repeated five times every ten minutes, but it produced very slight nausea. I shortly after bled him to sixty ounces without syncope; and after keeping up the extension gradually for about two hours, with all the force one man could employ with the pulleys, we found the limb as long as the opposite; we then endeavoured to lift the head of the bone over the acetabulum, by means of a towel under the thigh and over one of our heads, at the same time rotating the limb outwards with all the force we were able to exert; the foot at length became somewhat turned out, and the head of the bone to be less distinctly felt, and in about half an hour we heard a grating of the head of the bone, when the man instantly exclaimed it was replaced*; and, upon examination, finding the foot turned out, the limb of its natural length, and no appearance of the head of the bone on the dorsum illi, we concluded it must be within the acetabulum, and desisted from any further violence, put the man to bed, and tied his legs

* In dislocations which have long remained unreduced, the bones do not usually snap into the socket at its reduction.—A. C.

together ; his foot immediately became sensible, which it had not been before, since the accident, and he altogether felt easier. A large blister was applied over the trochanter, and he slept well in the night, and complained only of pain in the perineum and just above the knee, where the bandages had been applied ; there was no subsequent fever, nor any unpleasant symptom whatever.

In a few days the man could bear slight flexion and extension without pain, and in a week some degree of rotation ; the limb became gradually stronger, and the power of motion so increased, that on the twelfth day he could by himself bring the thigh at right angles with the body. He was now taken out of bed ; bandages were applied round the thigh and pelvis ; and he could stand perfectly upright, so as to walk with his heel on the ground with the assistance of crutches : and from exercise, he grew so rapidly stronger, that on the twenty-second day he left off one crutch, and on the twenty-fifth the other. In a month he was able to walk without a stick ; and in five weeks, having particular business, he walked nearly twenty miles, perfectly upright and without the least limping.

S. NOTT.

Collumpton, Devon, Jan. 27, 1820.

I attended the following case, which forms a striking contrast to the preceding, and to some of those hereafter related.

Case.

I was desired to visit a man aged twenty-eight years, who, by the overturning of a coach, had dislocated his left hip more than five weeks before ; and who had been declared not to have a dislocation, although the case was extremely well marked. His leg was full two inches shorter than the other ; his knee and foot were turned inwards ; and the inner side of the foot rested upon the metatarsal bones of the other leg. The thigh was slightly bent towards the abdomen, and the knee was advanced over the other thigh. The head of the thigh-bone could be distinctly felt upon the dorsum of the ilium : and when the two hips were compared, the natural roundness of the dislocated side had disappeared.

I used only mechanical means in my attempts at reduction; and although I employed the pulleys, and varied the direction of repeated extensions, I could not succeed in replacing the bone, and this person returned to the country with the dislocation unreduced.

The next case was communicated to me by Mr. Norwood, surgeon, Hertford.

William Newman, a strong muscular man, nearly thirty years of age, was admitted into Guy's Hospital on Wednesday, December 4, 1812, for a dislocation of the hip-joint. In springing from the shafts of a waggon, on Thursday, November 7th, his foot slipped, and his hip was driven against the wheel with considerable force. He immediately fell, and being unable to walk, was carried to Kingston Workhouse, near the place where the accident happened. On the evening of that day, he was examined by a medical man, but the nature of the accident was not ascertained. He remained at Kingston until the 30th of November, and was then removed to Guildford, his place of residence, and on the 4th of December, to Guy's Hospital. On examination, the head of the thigh-bone was found resting on the dorsum ilii: the trochanter was thrown forward towards the anterior superior spinous process of the ilium. The knee and foot were turned inwards, and the limb was shortened one inch and a half; the great toe rested upon the metatarsal bone of the other foot, and there was but little motion in the limb.

On Saturday, the 7th of December, thirty days after the accident, an extension was made to reduce the limb; and previously to the application of the bandage, he was bled to twenty-four ounces from his arm; in about ten minutes after, he was put into a warm bath, where he remained until he became faint, which happened in fifteen minutes: a grain of tartarized antimony was then given him, and repeated in sixteen minutes, as the first dose did not produce nausea. The most distressing nausea was now quickly produced, but he did not vomit; and while under the influence of

this debilitating cause, he was carried into the operating theatre in a state of great exhaustion. Being placed on a table on his left side, the bandage was applied in the usual manner to fix the pelvis, and the pulleys were fastened to a strap around the knee; the thigh was drawn obliquely across the other, not quite two-thirds of its length downwards, and the extension was continued for ten minutes, when the bone slipped into the socket. The man was discharged from the hospital in three weeks from the period of his admission, making a rapid progress towards a recovery of the perfect use and strength of the limb.

From the following cases it will be seen we are not to despair of success, even when a considerable time has elapsed after the accident.

Case. Mr. Mayo has mentioned the case of William Honey, who came into the hospital in August, 1812. The dislocation had taken place seven weeks before, and was reduced the day after his admission. He was discharged cured, on the 18th of November. —This was a dislocation on the dorsum ilii.

Case. Mr. Tripe, surgeon at Plymouth, has sent to the Medico-Chirurgical Society, an account of a case of dislocation of the thigh-bone on the dorsum ilii, which had happened seven weeks and one day prior to his making an extension, in which he was so fortunate as to succeed in restoring the bone to its natural situation.

The following instances prove, indeed, that the dislocation on the dorsum ilii may be reduced without pulleys; but they show at the same time how desirable that mechanical aid would have been, especially in the first two instances.

Case. William Piper, aged twenty-five years, sustained an injury from the wheel of a cart, laden with hay, which passed between his legs, and over the upper part of his right thigh. Mr. Holt, surgeon at Tottenham, was sent for nearly a month after the accident: he found him in great pain, attended with fever, and with much local inflammation and tension. He bled him copiously, purged him

freely, and applied leeches. The injured leg was shorter than the other, and the head of the bone was seated upon the dorsum ilii: the knee and foot were turned inwards.

As I visited Tottenham frequently at that time, Mr. Holt asked me to accompany him to see the man, and we agreed on the propriety of making a trial at reduction. Mr. Holt and myself, assisted by five strong men exerted our best endeavours for that purpose. Repeatedly fatigued, we were several times obliged to pause and then renew our attempt. At length exhausted, we were about to abandon any further trial, but agreed to make one last effort; when at fifty-two minutes after the commencement of the attempt the bone slipped into its socket.

In a case also, which I attended with Mr. Dyson, in Fore-street, Case. I succeeded in reducing the limb without the use of pulleys; but the violence used was so great, and the extension so unequal, (our fatigue being nearly as severe as that of the patient,) that I am confident no person who had used pulleys in dislocation of the hip, would have recourse to any other mode, excepting in dislocation into the foramen ovale.

In the following case, sent me by Mr. Oldknow of Nottingham, the extension was made at the ankle; it is consequently worthy of notice.

William Sharpe, an athletic young man, in wrestling received a Case. fall; his antagonist falling with and upon him, their legs were so entangled that he cannot say how he came to the ground. He complained of great pain in the hip, and was incapable of rising. About twenty minutes after the accident, I found him lying on his belly in the field where it had occurred, and the left limb in a trifling state of abduction, shortened, and the knee and foot turned inwards; the prominency of the trochanter gone, and the head of the bone obscurely felt on the dorsum ilii. He was conveyed home; and in order to reduce the dislocation,—for such I considered it,—I placed the man on his right side diagonally across a four post bedstead. The centre of a large sheet rolled up, was

passed in front and behind the body, and fastened to the upper bed-post as low as possible. The centre of a napkin, rolled in like manner, was then applied upon the dorsum ilii, between its crista and the dislocated bone; and each extremity being brought under the sheet, forwards and backwards, was reflected over it and tied in the centre, by which means I hoped to keep the pelvis secure. The counter extending force was applied above the ankle, (it appearing to me to interfere less with the muscles upon the thigh,) first by rolling round a wetted towel, and then placing upon this the end of a long or jack-towel. Three men were now directed to pull gradually and steadily: and when I perceived that the head of the femur was brought down to the edge of the acetabulum, I raised it a little with my clasped hands placed under the upper part of the thigh, and immediately the head of the bone entered the cotyloid cavity with a smart snapping noise. The man had considerable pain about the hip and knee for some time, but is now quite well.

I have met with many instances of these accidents conjoined with another injury, which at first sight presented a complication sufficiently embarrassing, but without being, in reality, productive of much additional difficulty. I allude to cases in which, with dislocation of one hip, there has been a fracture of the bone of the opposite thigh. In such circumstances, I have fixed some splints temporarily, but very firmly upon the broken limb, and then, turning the patient on that side, have proceeded to the reduction of the dislocated hip in the usual way. After this has been accomplished, I have taken the splints from the broken limb, and bound it up again in the customary manner; and every case which I have seen, has done well, without any additional inconvenience.

DISLOCATION OF THE THIGH UPON THE DORSUM ILII, WITH FRACTURE
OF THE THIGH-BONE.

Case.

Abraham Harman, aged thirteen years, a patient under Mr. Forster in Guy's Hospital, gave the following account of his acci-

nt :—About four months prior to this time, he drove his master's rses to a chalk pit; he went down into the pit to pack the chalk, d to break it into small pieces; and while he was thus occupied : side of the pit gave way and a large piece of chalk striking n violently on the hip knocked him down. Being immediately en to a neighbouring public-house, a surgeon was sent for. e thigh was discovered to be fractured near its middle, but very nsiderable contusions prevented the dislocation from being at st discovered. Fomentation and other means of reducing the elling at the hip having been employed, it was ascertained that : thigh was also dislocated, and some attempts were made to re- ce it; but the fracture would not then bear the extension, and : boy was sent to the hospital. No attempt has since been de to reduce the bone.

This case presented unusual difficulties; and the probability is, t dislocation thus complicated with fracture, will, generally, not nit of reduction; as extension cannot be made until three or four nths have elapsed from the accident, and then only with strong ints upon the thigh, to prevent the risk of disuniting the fracture.

DISLOCATION DOWNWARDS, OR INTO THE FORAMEN OVALE.

The foramen ovale is formed by the junction of two bones—the *Anatomy.* rium and pubes: it is situated below the acetabulum, and is ewhat near the axis of the body. It is filled by a ligament ch proceeds from the edges of the foramen, and has an opening ts upper and anterior part, to permit the passage of the obtu- or blood-vessels, and the obturator nerve. It is covered on its ernal and internal surface by the obturator externus and obtu- or internus muscles.

This dislocation happens when the thighs are widely separated n each other. The ligamentum teres and the lower part of the *Cause of acci-* sular ligament are torn through, and the head of the bone be- dent. es situated in the posterior and inner part of the thigh, upon obturator externus muscle.

t has been erroneously supposed, that the ligamentum teres is

not torn through in this dislocation; because in the dead body, when the capsular ligament is divided, the head of the bone can be drawn over the lower edge of the acetabulum without tearing the ligamentum teres. But the dislocation in the foramen ovale happens whilst the thighs are widely separated, during which act the ligamentum teres is upon the stretch; and when the head of the bone is thrown from the acetabulum, this ligament is torn through before it entirely quits the cavity.

Symptoms.

The limb is in this case two inches longer than the other. The head of the bone can be felt by pressure of the hand upon the inner and upper part of the thigh towards the perinæum, but only in very thin persons. The trochanter major is less prominent than on the opposite side. The body is bent forwards by the tension of the psoas and iliacus internus muscles. The knee is considerably advanced if the body be erect; it is widely separated from the other, and cannot be brought without great difficulty near the axis of the body to touch the other knee, in consequence of the extension of the glutei and pyriformis muscles. The foot, though widely separated from the other, is generally neither turned outwards nor inwards, although I have seen it varying a little in this respect in different instances; but the position of the foot does not in this case mark the accident. The bent position of the body, the separated knees, and the increased length of the limb, are the diagnostic symptoms. The position of the head of the bone is below, and a little anterior to, the axis of the acetabulum; and a hollow is perceived below Poupart's ligament.

Specimen dissected by Sir Astley.

There is an excellent preparation of this accident in the collection at St. Thomas's Hospital, which I dissected many years ago. The head of the thigh-bone was found resting in the foramen ovale, but the obturator externus muscle was completely absorbed, as well as the ligament naturally occupying the foramen, now entirely filled by bone. Around the foramen ovale bony matter was deposited, so as to form a deep cup, in which the head of the thigh-bone was inclosed, but in such a manner as to allow of considerable motion; the cup thus formed, surrounded the neck of the

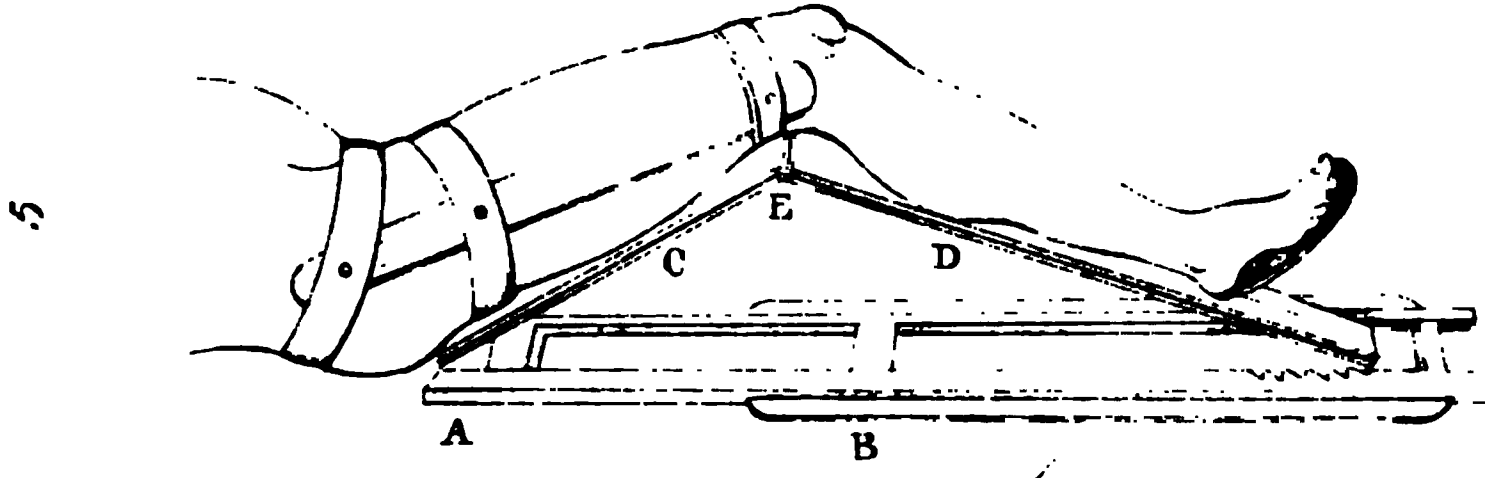
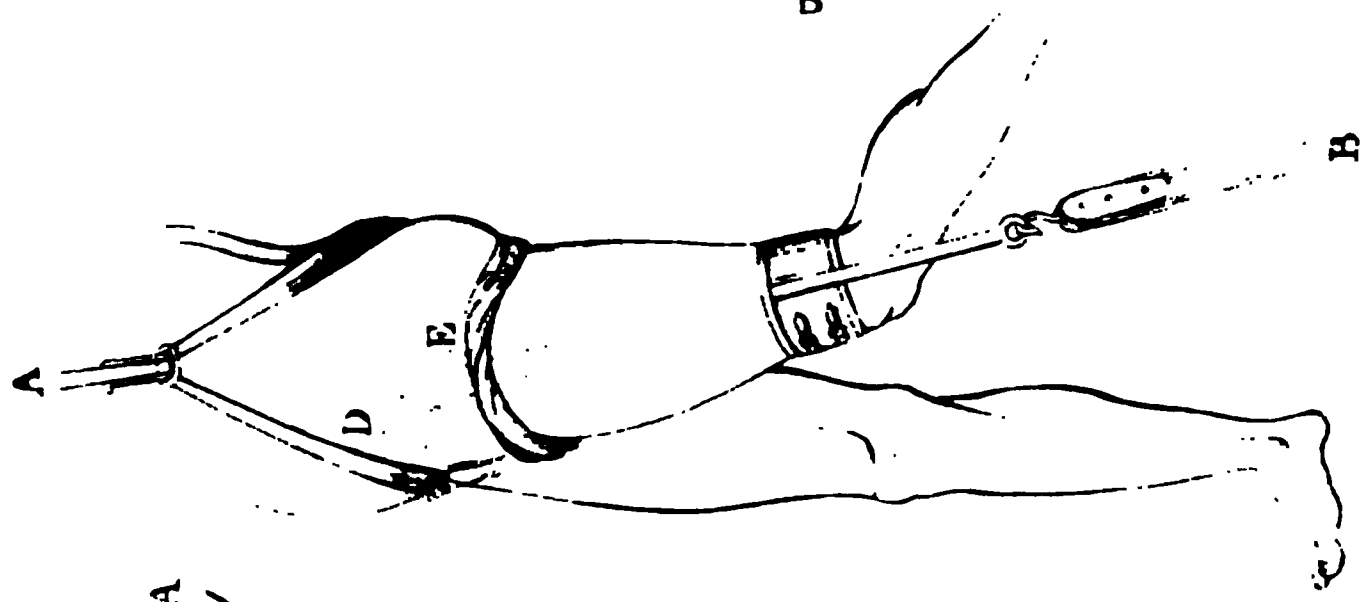
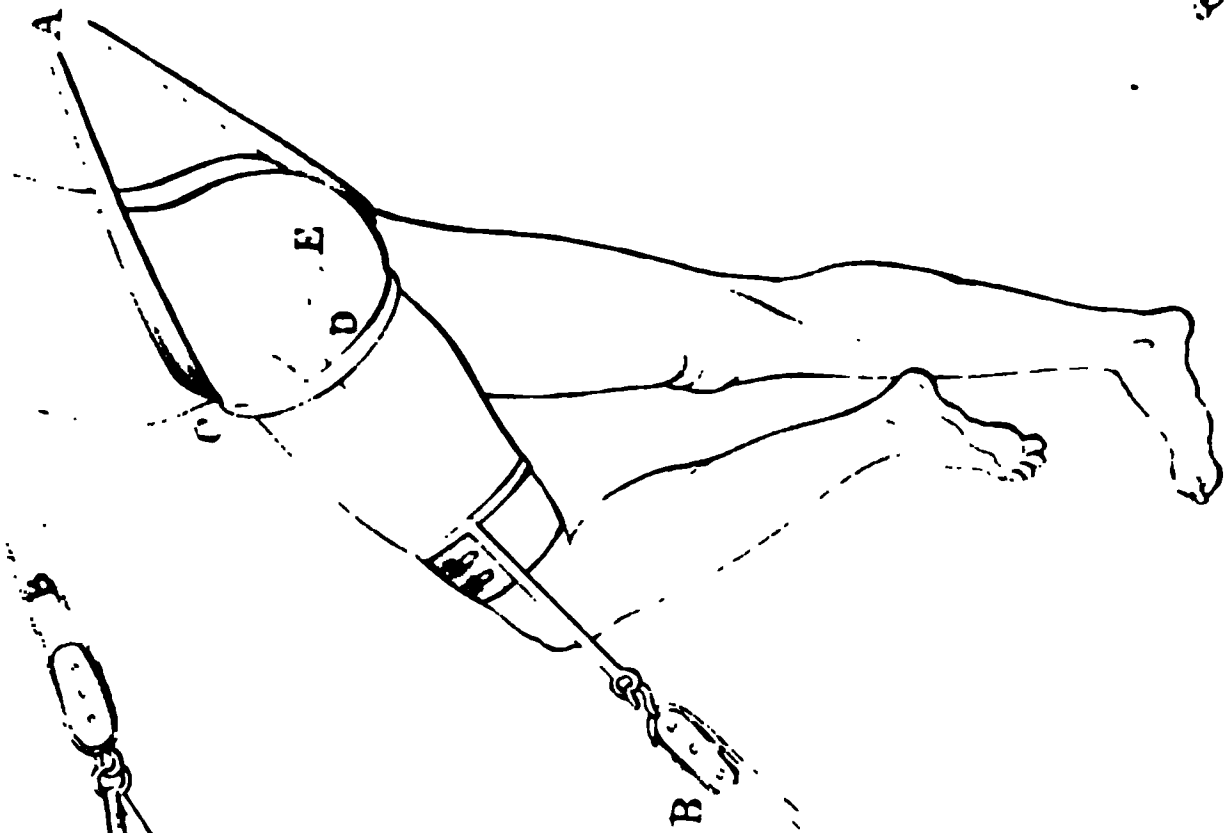
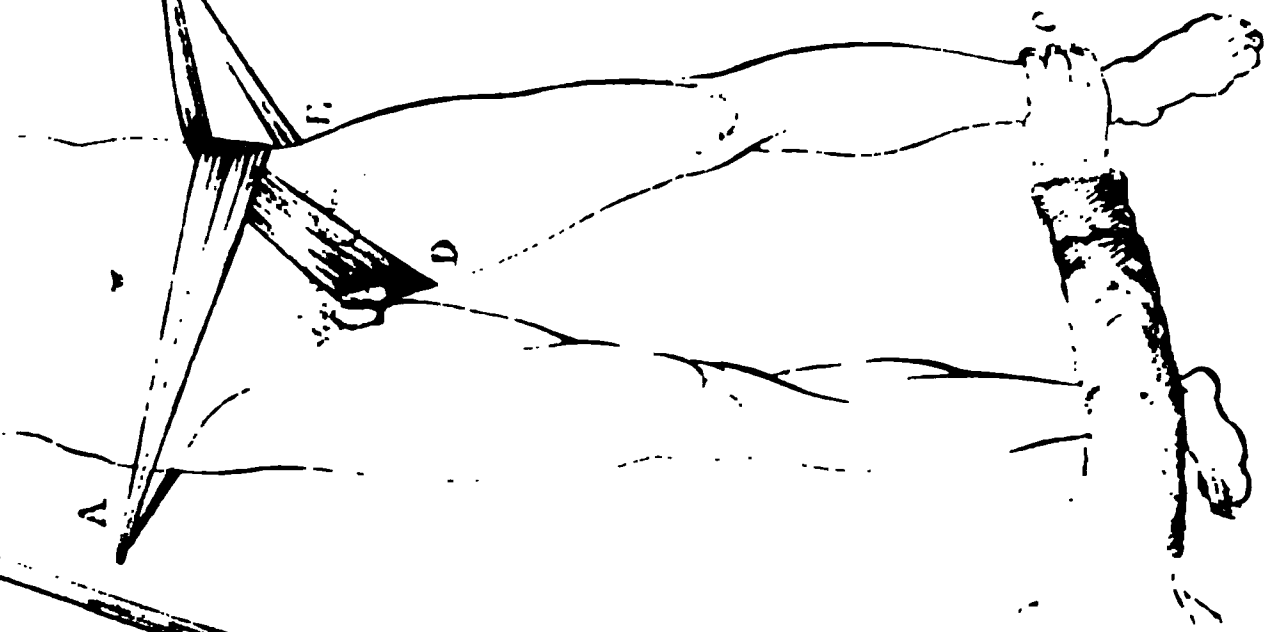
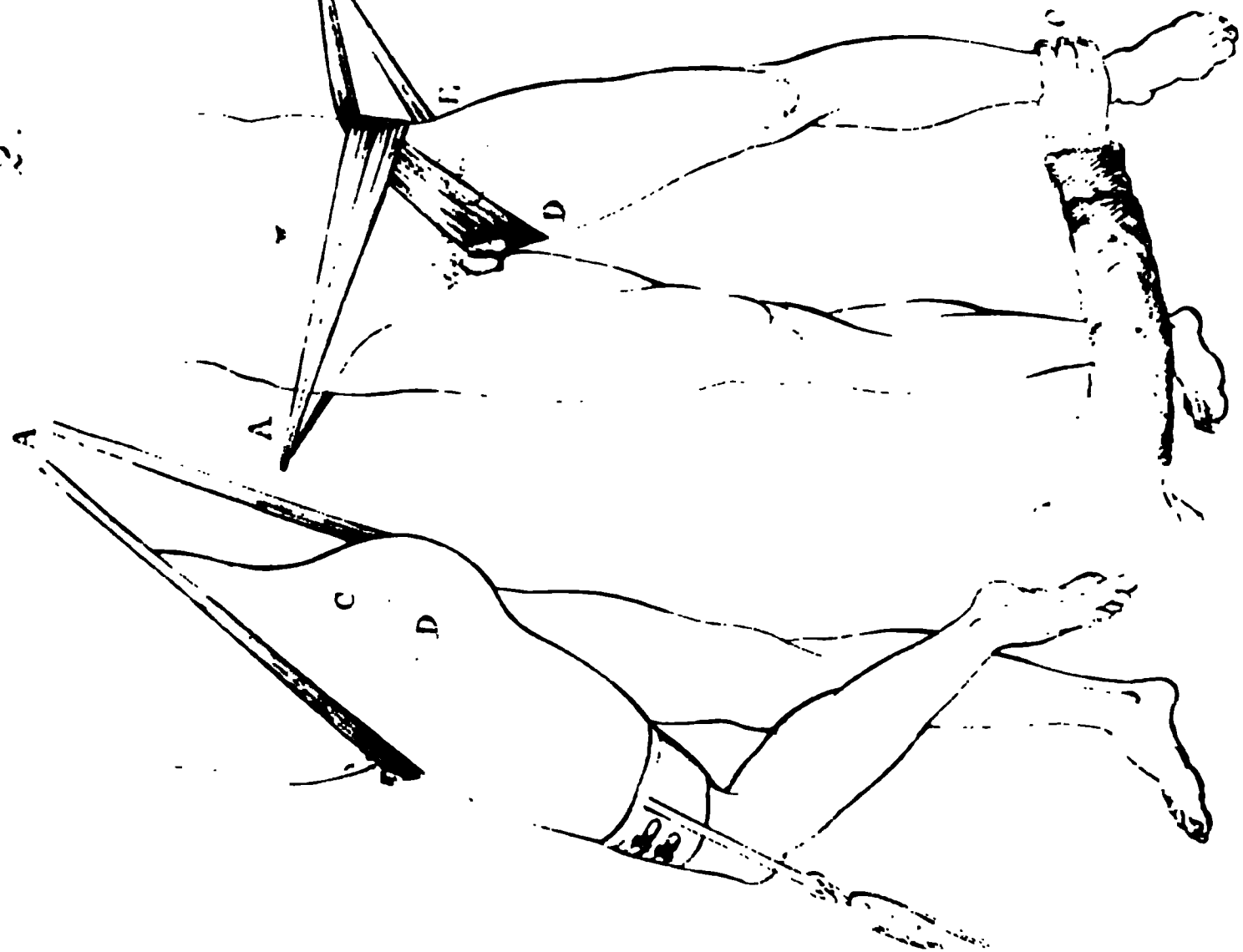


PLATE XII.

PLATE XII.

Fig. 1. The mode of reducing the dislocation upwards, on the dorsum ilii.

- a*, The band passed between the thighs to fix the pelvis.
- b*, The pulley fixed above the knee, and the direction shewn in which the thigh is to be drawn: i. e. obliquely across the sound thigh.
- c*, Head of the bone upon the dorsum ilii.
- d*, Acetabulum.

Fig. 2. Dislocation in the foramen ovale.

- a*, Bandage to fix the pelvis.
- b*, The pulley to draw the head of os femoris outwards and upwards.
- c*, The surgeon's hand grasping the ancle to draw the one leg across the other, and to throw the head of the bone outwards.
- d*, The head of the bone in the foramen ovale.
- e*, Acetabulum into which the head of the bone is to be brought.

Fig. 3. The mode of reducing the dislocation in the ischiatic notch.

- a*, The bandage to fix the pelvis.
- b*, The pulleys fixed above the knee.
- c*, A band surrounding the thigh, by which the surgeon is to elevate the bone, when the extension has been continued for some time.
- d*, The acetabulum.
- e*, The head of the bone in the ischiatic notch.

Fig. 4. Best mode of reducing the dislocation of the os femoris upon the pubes.

- a*, The bandage to fix the pelvis.
- b*, The pulleys, applied downwards and backwards.

PLATE XII., CONTINUED.

- c*, A band passed around the thigh to enable the surgeon to raise the head of the bone during the extension.**
- d*, The head of the os femoris on the pubes.**
- e*, The acetabulum.**

Fig. 5. The inclined plane for simple fracture of the thigh and trochanter major.

- a*, Frame to rest upon the bed.**
- b*, Two lateral supporters to *a*.**
- c*, The plane for the thigh.**
- d*, The plane for the leg.**
- e*, The joint.**

thigh-bone without touching it, and so inclosed its head, that it could not be removed from its new socket without breaking its edges. The inner side of this new cup was extremely smooth, not having the least ossific projection at any part to impede the motion of the head of the bone, which was only restrained by the muscles from extensive movements. The original acetabulum was half filled by bone, so that it could not have received the ball of the thigh-bone if an attempt had been made to return it into its natural situation. The head of the thigh-bone was very little altered; its articular cartilage still remained; the ligamentum teres was entirely broken, and the capsular ligament was partially torn through; the pectinalis muscle and adductor brevis had been lacerated, but were united by tendon; the psoas muscle and iliacus internus, the glutei and pyriformis, were all upon the stretch. Nothing can be more curious, or, to the surgeon and physiologist, more beautiful, than the changes produced by this neglected accident, exemplifying the resources of nature in producing restoration.

The reduction of this dislocation, is, in general, very easily effected. If the misfortune be of recent occurrence, it is requisite to place the patient upon his back, to separate the thighs as widely as possible, and to place a girth between the pudendum and the upper part of the luxated thigh, fixing it to a staple in the wall. The surgeon then puts his hand upon the angle of the dislocated side, and draws it over the sound leg, or, if the thigh be very large, behind the sound limb, and the head of the bone slips into its socket. I saw a dislocation thus reduced, which had happened very recently, and which was subjected to an extension in St. Thomas's Hospital, almost immediately after the patient's admission. In a similar case, the thigh might be fixed by a bed-post received between the pudendum and the upper part of the limb, and the leg be carried inwards across the other. But in general it is required to fix the pelvis by a girth passed around it, and crossed under that which passes around the thigh, to which pulleys

Reduction.

are to be attached, otherwise the pelvis will move in the same direction with the head of the bone.

In those cases in which the dislocation has existed for three or four weeks, it is best to place the patient upon his sound side; to fix the pelvis by one bandage, and to carry under the dislocated thigh another bandage, to which the pulleys are to be affixed perpendicularly; then to draw the thigh upwards, whilst the surgeon presses down the knee and foot, to prevent the lower part of the limb from being drawn with the thigh-bone. Thus the limb is used as a lever of very considerable power. Great care must be taken not to advance the leg in any considerable degree, otherwise the head of the thigh-bone will be forced behind the acetabulum into the ischiatic notch, from whence it cannot be afterwards reduced.

DISLOCATION OF THE RIGHT THIGH INTO THE FORAMEN OVALE.

Case.

A gentleman riding on horseback on the 4th of January, 1818, the animal suddenly started to the right side; and in endeavouring to keep his seat by the pressure of the right thigh against the saddle, he was thrown, and the fall occasioned a severe contusion upon his head, which produced alarming symptoms. On the following day it was observed the right thigh was useless, and that the knee was raised and could not be brought into a straight line with the other, having at the same time a direction outwards, which required it to be tied to the other knee: the symptoms of injury to the head precluded, at this time, any attempt at reduction. In fourteen days he was so far recovered that he was able to rise from his bed, and in a month he began to walk with crutches.

On November 1st, 1818, I first saw him; and the appearances of the injured limb were then as follow:—The thigh was longer than the other by the length of the patella; the knee was advanced; and when he was in the recumbent posture, the injured leg could not be drawn down to the same length with the other.

The upper part of the thigh-bone was thrown backwards, so as to render the hollow of the groin on the injured side deeper than that on the other. The toes were rather everted; but when the body was erect, were capable of resting on the ground, though the heel was not. The head of the bone could not be felt, and the trochanter was much less prominent than usual. When the upper part of the thigh-bone was pressed against the new acetabulum, and moved, there was a sensation of friction between two cartilaginous surfaces; which, although not easily described, is readily distinguished from the crepitus occasioned by a fractured bone. In a sitting posture the injured leg was two inches longer than the other; and to that degree the knee was projected beyond the sound one. In progression, the knee was bent; and the body being thrown forwards, the patient rested chiefly upon his toe, and halted exceedingly in walking. The sartorius and gracilis muscles were put very much upon the stretch. At first he suffered from pain in the dislocated hip and thigh, but that is not now the case unless he attempts to stand on that limb only. His toe at first was with difficulty brought to the ground, but he is now improved in walking; for on the first trial, with the assistance of a crutch and stick, he could not exceed half a mile, but is now able to walk two miles. In flexion his thigh admits of considerable motion, but he cannot extend it further than to bring the ham to the plane of the other patella. The knees cannot be brought together, but he advances one before the other in the attempt. He can sit without pain, but the jolting of a carriage hurts him exceedingly; and the attempt to sit on horseback produces excessive suffering. He cannot straighten his leg when his body is erect, nor can he stoop to tie his shoe on the injured side. Pain is produced by resting on that hip in bed. No attempt was made to reduce the limb; the injury to the head might have rendered it dangerous in the commencement, and at the time when I saw him there was no chance of success.

DISLOCATION OF THE RIGHT FEMUR DOWNWARDS, OR INTO THE FORAMEN OVALE.

Case.

Mr. Thomas Clarke, a farmer, about fifty years of age, was driving home in his cart from market, when the horse took fright and ran away with him. The following is the account he gives of the manner in which the accident happened:—In his endeavour to stop the horse, he fell over the front of the cart on his face, and the knee struck against some part of it in the act of falling, by which means the thighs were separated; the wheel, he also states, passed over his hip*.

My friend, Mr. Potter, of Ongar, in Essex, whose ability as a surgeon in that neighbourhood is justly appreciated, was consulted in this case, between two and three weeks after the accident happened. The nature of the accident was extremely evident: the limb was full three inches longer than the other, the body bent forwards, the knees separated, and the foot rather inclined outwards; these were the leading diagnostic marks. Mr. Potter, having clearly ascertained the position of the dislocated limb, I accompanied him the following morning, in order to assist in the reduction; and the following were the means employed.

Our first object was to produce relaxation; and finding the patient was sufficiently strong to bear the plan usually recommended in cases of dislocation, where much resistance is expected, we drew away some blood from the arm; this, however, was not sufficient for our purpose, and a solution of tartar emetic, which we had brought with us, was administered. The patient was laid upon his side, close to the edge of the bed, (that being the most convenient place,) a girth was passed round the pelvis, and carried through the frame of the bedstead, which completely prevented the possibility of the body moving whilst extension was going on; a second girth was applied between the thighs, fixed to the one above, to which the pulleys were attached. Whilst extension was making, Mr. Potter took hold of the limb at the knee, and drew it

* Query.—Was this, or the extended state of the limbs, the cause of the dislocation?

rather upwards, and towards the sound thigh, occasionally rotating the limb. When the extension had been continued about ten minutes, the nausea produced by the tartar emetic was so excessive, that the patient begged of us to desist until the morrow, observing, he felt so bad that he was fearful of falling off the bed; this exclamation, it hardly need be said, was a stimulus to our proceeding; and in five minutes after, the limb was suddenly heard to snap into its original cavity. The patient was put to bed, a roller being applied round the pelvis. At the end of five days, he felt so well that he left his room; and in a short time suffered no other inconvenience than stiffness in the joint.

Although a dislocation into the foramen ovale may be occasionally reduced by attempts made in a very inappropriate direction, yet an instance has occurred that shews the mischief that may arise from an error in this respect. I subjoin the following.

Mischief from improper extension.

A boy, sixteen years old, had a dislocation of the thigh into the foramen ovale: he was placed upon his sound side, and an extension of the superior part of the thigh was made perpendicularly; the surgeon then pressed down the knee, but the thigh being at that moment advanced, the head of the bone was thrown backwards, and passed into the ischiatic notch; from which situation it could not be reduced.

Case.

DISLOCATION BACKWARDS, OR INTO THE ISCHIATIC NOTCH.

The space which is called the ischiatic notch, is bounded above and anteriorly by the ilium, posteriorly by the sacrum, and inferiorly by the sacro-sciatic ligament. It is formed for the purpose of giving passage to the pyriformis muscle and to the sciatic nerve, as well as to the three arteries—the glutæi, the ischiatic, and the internal pudendal. In the natural position of the pelvis, it is situated posteriorly to the acetabulum and a little above its level. When the head of the bone is thrown into this space, it is placed backwards and upwards, with respect to the acetabulum; therefore, although I call this the dislocation backwards, it is

Anatomical structure.

to be remembered that it is a dislocation backwards and a little upwards.

Nature of the accident.

In this dislocation the head of the thigh-bone is placed on the pyriformis muscle, between the edge of the bone which forms the upper part of the ischiatic notch, and the sacro-sciatic ligaments, behind the acetabulum, and a little above the level of the middle of that cavity.

Detection difficult.

This dislocation is the most difficult both to detect and to reduce: to detect, because the length of the limb differs but little, and its position, in regard to the knee and foot, is not so much changed as in the dislocations upwards: to reduce, because the head of the bone is placed deep behind the acetabulum, and it therefore requires to be lifted over the edge of that cavity as well as to be drawn towards its socket.

Signs.

The signs of this dislocation are, that the limb is from half an inch to one inch shorter than the other, but generally not more than half an inch; that the trochanter major is behind its usual place, but is still remaining nearly at right angles with the ilium, with a slight inclination towards the acetabulum. The head of the bone is so buried in the ischiatic notch, that it cannot be distinctly felt, except in thin persons, and then only by rolling the thigh-bone forwards as far as the comparatively fixed state of the limb will allow. The knee and foot are turned inwards, but less than in the dislocation upwards; and the toe rests against the ball of the great toe of the other foot. When the patient is standing, the toe touches the ground, but the heel does not quite reach it. The knee is not so much advanced as in the dislocation upwards, but is still brought a little more forwards than the other, and is slightly bent. The limb is so fixed that flexion and rotation are in a great degree prevented.

Specimen in St. Thomas's Hospital.

There is a good specimen of this accident in the collection at St. Thomas's Hospital, which I met with accidentally, in a subject brought for dissection. The original acetabulum is entirely filled with a ligamentous substance, so that the head of

the bone could not have been returned into it. The capsular ligament is torn from its connection with the acetabulum, at its anterior and posterior junction, but not at its superior and inferior. The ligamentum teres is broken, and an inch of it still adheres to the head of the bone. The head of the bone rests behind the acetabulum on the pyriformis muscle, at the edge of the notch, above the sacro-sciatic ligaments. The muscle on which it rests is diminished, but there has been no attempt made to form a new bony socket for the head of the os femoris. Around the head of the thigh-bone a new capsular ligament is formed; it does not adhere to the articular cartilage of the ball of the bone which it surrounds, but could, when opened, be turned back to the neck of the thigh-bone, so as to leave its head completely exposed. Within this new capsular ligament, which is formed of the surrounding cellular membrane, the broken ligamentum teres is found. The trochanter major is placed rather behind the acetabulum, but inclined towards it relatively to the head of the bone.

In this specimen, from the appearance of the parts, the dislocation must have existed many years; the adhesions were too strong to have admitted of any reduction, and if reduced, the bone could not have remained in its original socket.

This species of dislocation is produced by the application of force, when the body is bent forward upon the thigh, or when the thigh is bent at right angles with the abdomen; in which positions, if the knee be pressed inward, the head of the bone is thrown behind the acetabulum. Cause.

The reduction of the dislocation into the ischiatic notch, is, in general, extremely difficult, and is best effected in the following manner:—The patient should be laid on a table upon his side, and a girth should be placed between the pudendum and the inner part of the thigh, to fix the pelvis: then a wetted roller is to be applied around the knee, and the leathern strap over it. A napkin is to be carried under the upper part of the thigh. The thigh-bone is then to be brought across the middle of the other thigh,

measuring from the pubes to the knee, and the extension is to be made with the pulleys. Whilst this is in progress, an assistant pulls the napkin at the upper part of the thigh with one hand, rests the other upon the brim of the pelvis, and thus lifts the bone, as it is drawn towards the acetabulum, over its lip. For the napkin I have seen a round towel very conveniently substituted, and this was carried under the upper part of the thigh, and over the shoulders of an assistant, who then rested both his hands on the pelvis, as he raised his body, and lifted the thigh.

Although the preceding is the method in which this dislocation is most easily reduced, yet I have seen a different mode practised; and I shall mention it here, as it shows how the muscles opposing the pulleys will draw the head of the bone to its socket, when it is lifted from the cavity into which it has fallen.

Case.

A man, aged twenty-five, was admitted into Guy's Hospital under the care of Mr. Lucas; upon examination, the thigh was found dislocated backwards; the limb scarcely differed in length from the other, being not more than half an inch shorter; the groin appeared depressed; the trochanter was resting a little behind the acetabulum, but inclined upon it; the knee and foot were turned inwards, and the head of the bone could, in this case, be felt behind the acetabulum. An extension was made by pulleys in a right line with the body; at the same time the trochanter major was thrust forward with the hand, and the bone returned in about two minutes into its socket with a violent snap.

I have already mentioned, that I have seen no instance of a *dislocation downwards and backwards*; and when I state, that I have been an attentive observer of the practice of our hospitals for thirty years, was also for many years in the habit of daily seeing the poor of London at my house early in the morning, and have had a considerable share of private practice, I may be allowed to observe, that if such a case does ever occur, it must be extremely rare. I cannot help thinking, also, that some anatomical error must have given rise to this opinion, as in the dislocation down-

wards and backwards, the head of the bone is described as being received still into the ischiatic notch; but this notch is, in the natural position of the pelvis, above the level of the line drawn through the middle of the acetabulum; and hence it is, that the leg becomes, not shorter, but longer, when the bone is dislocated into the ischiatic notch.

The following case I received from Mr. Rogers, a very intelligent surgeon at Manningtree. The kind manner in which he has expressed himself, may savour a little of vanity; but I shall readily suffer this imputation, and not shrink from avowing the satisfaction which I feel, whenever my endeavours have in any degree conduced to the advantage of my professional brethren, or to the benefit of those who may be placed under their care.

DISLOCATION OF THE THIGH INTO THE ISCHIATIC NOTCH.

William Dawson, aged thirty-four, on the 15th of August, 1818, Case. while spending his harvest home with several of his companions, was thrown down and trod upon. Upon extricating himself and endeavouring to rise, he found that some serious injury to his right thigh rendered him incapable of standing: in this state he was dragged by his associates for many hundred yards into a stable, where he lay till the next morning. I then saw him lying upon a mattress, with the hip and thigh on the right side prodigiously swollen and painful; and was particularly struck with the appearance of the knee and foot on the same side, which were very much turned inwards, but the limb was scarcely shortened. I ordered him to be carefully conveyed home upon a shutter, supported by six men, a distance of about half a mile. From the immense swelling and general enlargement of the whole thigh, and of the soft parts around the pelvis, it was impossible to ascertain exactly the state of the injury; but I was fully impressed there was some unusual dislocation of the head of the thigh-bone. He was accordingly bled, both by general and topical means, and emollient poultices applied to the whole of the swollen parts;

brisk purgatives were also administered, succeeded by saline medicines, and a quiet position was enjoined for eleven days, by which time the swelling began somewhat to subside. Still the precise nature of the injury was not satisfactorily evident; but it was thought by Mr. Nunn of Colchester, and Mr. Travis of East Bergholt, who had kindly come over to witness it, that there was a luxation. The only difficulty we had in reconciling ourselves to this notion was, the belief in our minds that no author adduced an instance of this accident, without an alteration in the length of the limb, except it might be Mr. Astley Cooper, in his new publication, which neither of us had yet seen. We accordingly had recourse to a minute examination of the skeleton; when we immediately fancied we could account for the absence of the usual marked signs of displacement of the head of the bone, excepting the inversion of the knee and foot, in this kind of luxation; for we noticed, that if the head of the bone be luxated sideways into the ischiatic notch, it will produce scarcely any difference in the length of the limb. Trusting that a little further delay might not be attended with any material disadvantage, but give a chance for the entire subsidence of all the inflammation and swelling, we proposed meeting again as soon as we conveniently could, by which time we might consult Mr. Cooper's work. We accordingly met on Sunday, the 30th of August, which was fifteen days after the accident; and from the complete removal of all swelling, the whole of the femoral bone was satisfactorily traced to its rounded head, which was lodged in the ischiatic notch.

Upon referring to the book, which we had now before us, we found the case delineated and described; and as it was exhibited in a plate, we had only to imitate, in order to accomplish the reduction of the bone. In the presence of two or three other medical gentlemen we commenced the operation; but as it would be unnecessary to state every particular, considering the manner in which the position of the patient, and the fixing of the pulleys and towels, are demonstrated by that publication, suffice it to say,

that after ten or twelve minutes of gradual extension, the reduction of the bone was most readily and admirably accomplished.

Preparatory to commencing the operation we took thirty ounces of blood from the arm *ad deliquium*, and afterwards, while fixing the pulleys, &c., we gave four grains of tartarized antimony at intervals to produce nausea. Immediately after the operation, we gave one grain of opium, applied sedative lotions to the parts, and proceeding carefully for about a fortnight, the patient was enabled to move upon crutches, and shortly after went home perfectly well.

The dislocation into the ischiatic notch has been as far as I know, in every author who has written on the subject, incorrectly described ; for it has been stated, that the limb was lengthened in this accident, and I need scarcely mention the mistakes in practice which have originated in so erroneous an opinion ; one instance however of such an error I must here give. A gentleman wrote to me from the country in these words :—" I have a case under my care of injury of the hip, and I should suppose it a dislocation into the ischiatic notch, but that the limb is shorter, instead of being longer as authors state it to be." Into this error those authors must have fallen from having examined a pelvis separated from the skeleton, and observed that the ischiatic notch was below the level of the acetabulum when the pelvis was horizontal, although it is above the acetabulum in the natural oblique position of the pelvis, at least as regards the horizontal axis of the two cavities. It is to be remembered, that there is no such accident as a dislocation of the hip downwards and backwards.

Incorrect description by authors.

DISLOCATION ON THE PUBES.

This dislocation is more easy of detection than any other of the thigh. It happens when a person, while walking, puts his foot into some unexpected hollow in the ground ; and his body at the moment being bent backwards, the head of the bone is thrown forwards upon the os pubis. A gentleman who had met with this dislocation in his own person, informed me that it happened

Cause.

whilst he was walking across a paved yard in the dark: he did not know that one of the stones had been taken up, and his foot suddenly sunk into the hollow, and he fell backwards. When his limb was examined, the head of the thigh-bone was found upon the os pubis.

Symptoms.

In this species of dislocation the limb is an inch shorter than the other, the knee and foot are turned outwards, and cannot be rotated inwards, but there is a slight flexion forwards, and outward; and in a dislocation which had been long unreduced, the motion of the knee backwards and forwards was full twelve inches; but the striking criterion of this dislocation is, that the head of the thigh-bone may be distinctly felt upon the pubes, above the level of Poupart's ligament, on the outer side of the femoral artery and vein; and it feels as a hard ball there, which is readily perceived to move by bending the thigh-bone.

Not detected.

Although this dislocation is apparently easy of detection, I have known three instances in which it was overlooked, until it was too late for reduction: of one, there is a preparation at St. Thomas's Hospital; another occurred to a gentleman from the country, in whom it was not discovered until some weeks after the accident, who then submitted to an extension which did not succeed, and came to London to ask my opinion, when I advised him against a further attempt: to which, indeed, he himself was disinclined. The third, a patient in Guy's Hospital, who was admitted for an ulcerated leg, and found to have a dislocation upon the pubes, which had happened some years before. It really must be great carelessness which leads to this error, as the case is so strikingly marked.

**Dissection
of a case.**

I dissected one of these dislocations, and we have it preserved in our anatomical collection. It shews changes of parts nearly equal to those of the dislocation into the foramen ovale. The original acetabulum is partly filled by bone, and partly occupied by the trochanter major, and both are much altered in their form. The capsular ligament is extensively lacerated, and the ligamentum teres is broken. The head of the thigh-bone had torn up Pou-

part's ligament, so as to penetrate between it and the pubes. The head and neck of the bone were thrown into a position under the iliacus internus and psoas muscles; the tendons of which, in passing to their insertions over the neck of the bone, were elevated by it, and put on the stretch. The crural nerve passed on the fore part of the neck of the bone upon the iliacus internus and psoas muscles. The head and neck of the thigh-bone were flattened, and much changed in their form. Upon the pubes a new acetabulum was formed for the neck of the thigh-bone, the head of the bone being above the level of the pubes. The new acetabulum extended upon each side of the neck of the bone, so as to lock it laterally upon the pubes. Poupart's ligament confines it on the fore part; on the inner side of the neck of the bone passed the artery and vein, so that the head of the bone was seated between the crural sheath and the anterior and inferior spinous process of the ilium.

This accident might, by an inattentive observer, be mistaken for a fracture of the neck of the thigh-bone; but the head of the bone felt upon the pubes will decide its nature. Distinguished from fracture.

In the reduction of this dislocation, the patient is to be placed on his side on a table; a girth is to be carried between the pudendum and inner part of the thigh, and fixed in a staple a little before the line of the body. The pulleys are to be fixed above the knee, as in the dislocation upwards, and then the extension is to be made in a line behind the axis of the body, the thigh-bone being drawn backwards. After this extension has been for some time continued, a napkin is to be placed under the upper part of the thigh, and an assistant should press with one hand on the pelvis, and lift the head of the bone, by means of the napkin, over the pubes and edge of the acetabulum. Reduction.

The following case was admitted into St. Thomas's Hospital, under the care of Mr. Tyrrell.

Charles Pugh, aged fifty-five, a cooper, about the middle size, on the evening of the 23d of January, while standing at the corner of a street was struck on the back part of the right hip by the Case.

wheel of a cart, which knocked him down. He was taken up by some persons passing, who, finding that he was not able to walk, took him to St. Thomas's Hospital. The accident happened about nine o'clock in the evening, and I was sent for between twelve and one o'clock, when I found a dislocation of the right femur on the pubis; the particulars of which were as follow.

The head of the bone could be distinctly felt below Poupart's ligament, immediately on the outer side of the femoral vessels. The foot and knee were turned outwards, with very little alteration in the length of the limb. The thigh was not flexed towards the abdomen, and almost immovable, admitting only of partial adduction and abduction. The limb could be rotated outwards, but not at all inwards. I immediately had the man taken into the operating theatre, and speedily succeeded in reducing the dislocation by the following means:—The patient was placed on his left side, a broad band was passed between the thighs, and, being tied over the crista of the ilium on the right side, was made fast to a ring fixed in the wall. A wet roller having been put on above the right knee, a bandage was buckled over it, and its straps attached to the hooks of the pulleys, by which a gradual extension was made, drawing the thigh a little backwards and downwards. When this extension had been kept up a short time, I directed another bandage to be applied round the upper part of the thigh, close to the perinæum, by means of which the head of the bone was raised, and in the course of a few minutes the reduction was easily accomplished. The patient had not been bled, or taken any medicine; he suffered but little after the reduction, and was able to walk without pain or inconvenience five or six days afterwards. On the day following the accident, he could move the limb freely in all directions without pain, but did not attempt to walk until the period I have mentioned.

From what I have had an opportunity of observing on the subject of dislocations, I believe that the relative proportion of cases will be in twenty as follows:—*twelve* on the dorsum ilii; *five* in the ischiatic notch; *two* in the foramen ovale; and *one* on the pubes.

The cases I have here detailed, with the dates at which they were presented, manifest the frequent occurrence of this accident to the thigh. How it escaped the observation of surgeons of eminence of former times, is a matter of surprise that can only be accounted for by the difficulties which then existed in the pursuit of anatomy, and more especially of morbid anatomy; and it is a curious circumstance, that Mr. Sharpe, formerly surgeon of Guy's Hospital, author of a Treatise on Surgery, and in many respects an excellent surgeon, who had a large share of the practice of this metropolis, did not, as I was informed by Mr. Cline, believe that a dislocation of the thigh-bone ever occurred.

It is gratifying to observe the advancement of knowledge in the profession at the present period, compared with that of fifty years ago. What should we think of a surgeon of the present day, with all his opportunities of seeing disease in the large hospitals of this city, who doubted the existence of a dislocation of the thigh, when we find that our provincial surgeons immediately detect the nature of these injuries, and generally succeed in their attempts to reduce them? Let them never forget, however, that it is to the knowledge of anatomy, and more especially of morbid anatomy, that they are indebted for this superiority.

FRACTURES OF THE OS INNOMINATUM.

As these accidents are liable to be mistaken for dislocations, and **Mistakes.** as any extension made for them adds extremely to the patient's sufferings, and would be liable to produce fatal consequences if there existed previously a probability of recovery, I am anxious to say a few words upon them.

When a fracture of the os innominatum happens through the **Symptoms.** acetabulum, the head of the bone is drawn upwards, and the trochanter somewhat forwards, so that the leg is shortened, and the knee and foot are turned inwards: such a case may be readily mistaken for dislocation into the ischiatic notch. If the os innominatum is disjoined from the sacrum, and the pubes and ischium are broken, the limb is a slight degree shorter than the other; but

in this case, the knee and foot are not turned inwards, but outwards. Of the first of these accidents, I have seen two examples, of the latter only one.

Detection.

These accidents are generally to be detected by a perceptible crepitus on the motion of the thigh, if the hand be placed upon the crista of the ilium; and they are attended with more motion than occurs in dislocations.

Appearances on dissection.

A man was brought into St. Thomas's Hospital, in January, 1791, on whom a hogshead of sugar had fallen. Upon examination, the right leg was found about two inches shorter than the left, and the knee and foot were turned inwards; these circumstances induced the surgeon under whose care he fell to think the case a dislocation, although, as he stated, the limb appeared to be more moveable than usually happens in such accidents, and there was a great contusion and considerable extravasation of blood. The surgeon used the utmost caution in making a very slight extension, in order to bring the legs to an equal length, in which he did not succeed; and whilst it was performing, a crepitus was discovered in the os innominatum. The man had a remarkable depression of strength, and paleness of countenance, and appeared to be sinking.—In the evening he died.

Upon examination of the body, the following appearances were observed:—The posterior part of the acetabulum was broken off, and the head of the thigh-bone had slipped from its socket; the tendon of the obturator internus, and the gemini, tightly embraced the neck of the bone; the fracture extended from the acetabulum across the os innominatum to the pubes; the ossa pubis were separated at the symphysis nearly an inch asunder, and a portion of the cartilage was torn from the right pubes, and adhered to that on the left side; the ilia were separated on each side, and the pubes, ischium, and ilium broken on the left side: the abdomen contained about a pint of blood, and the left kidney was greatly bruised; the integuments were stripped off the patella and knee on one side, so as to expose the capsular ligament.

In a second case of this kind, which was admitted into St.

Thomas's Hospital, having the appearance of the dislocation backwards, the patient lived four days. On examination, the fracture was found passing through the acetabulum, dividing the bone into three parts ; and the head of the thigh-bone was deeply sunk into the cavity of the pelvis.

The following case of fracture and dislocation of the bones of the pelvis occurred in Guy's Hospital :—

Mary Griffiths, aged thirty, was admitted into Guy's Hospital Case. in the afternoon of the 8th of August, 1817. Her pelvis had sustained a severe injury from her body having been pressed by the wheel of a cart against a lamp-post.

A small quantity of blood had been taken from her arm previous to her admission ; and as she was very pale, her pulse extremely weak, and her fæces passed involuntarily, no more blood was drawn.

Soon after admission she was examined ; when by placing her on the face with one of my hands on the back of the right ilium, and the other on the pubes of the same side, a distinct motion and crepitus could be perceived. The posterior spine of the ilium projected upwards, above its usual junction with the sacrum, and it was thought that the ilium was dislocated from the sacrum, with some fracture either of the ilium or the sacrum. When turned on her back, and examined *per vaginam*, the pubes were found passing more into the cavity of the pelvis than usual. A large quantity of blood was effused from the last rib to the upper part of the thigh, on the right side.

It was now a question whether this extravasated blood should not be discharged by making an opening through the integuments as it appeared to be fluid ; but upon consideration, it was thought that the vessels would still bleed, that she could not bear the loss of blood in her weakened state, and that the blood, when coagulated, would form the best security against further effusion. All that was done, therefore, was to roll a broad bandage round the pelvis to fix it firmly, to give tinct. opii. gr. xxx., and to draw off the urine from her bladder, which contained about a pint.

In the evening, the extravasation of blood was somewhat increased, and she complained of a pricking sensation in the right thigh and leg, which induced her to loosen the bandage. She had vomited; her feet were cold; she had severe pain, and great thirst; her pulse was 90, and small.

On the 9th, she complained of a sensation of one side tearing from the other, and, upon examination of the lower extremities, that on the right side was found shorter than the other; there was numbness also on that side. Her tongue was furred, but her pain and thirst somewhat less; and she had not the same coldness in her feet as on the night previous. As her bowels had not been relieved since her admission, aperient medicine was given; and the bladder being incapable of emptying itself, a catheter was employed. The ecchymosis was of great extent, and it was doubtful whether it could be absorbed. A pillow was placed against the right side to support the pelvis, and another was put under the knee to preserve the limb in an easy position.

On the morning of the 10th, she complained that the bones of the pelvis moved upon each other, even more than at any former period, and that she had suffered severe pain; the tongue was now furred, pulse fuller, but her bowels had been relieved, and her water passed without assistance. At one o'clock this day, her pulse being fuller, and 120 in a minute, with great heat of skin, I bled her to the amount of ten ounces; but the blood did not exhibit any signs of inflammation, nor did the loss of blood produce any apparent effect in relieving her symptoms. In the evening, her pain and fever had increased; and as she complained of the tightness of the bandage which still surrounded the pelvis, it was removed. The catheter was then obliged to be employed. Some saline medicine, with opium, was ordered.

On the 11th, she stated that she had passed a good night. Pulse 120 and softer; tongue furred; she was directed to continue her medicines. A stimulating lotion was ordered on the 12th, to produce an absorption of the extravasated blood. Some spots appeared of a very dark colour, where the ecchymosis had been most

severe, and the cuticle was abraded upon those parts. From this day the excoriated parts, which had been excessively bruised, began to slough. On the 21st, the sloughing had increased; the tongue was furred; pulse 120. On the 22d, she was worse; and on the 23d, her stomach rejected every thing; she had a strong impression that she should not recover; she refused her medicine and the slough had increased. In the evening of the 24th, she died.

EXAMINATION.

On the 25th, the body was examined.—A fracture was found passing through the body of the pubes on the left side, and through the ramus of the left ischium.

The right os innominatum was separated from the sacrum at the sacro-iliac symphysis, and a part of the transverse processes of the sacrum was broken off, and torn from the sacrum with the ligaments. The cartilage and ligaments of the symphysis pubis were torn, and the left sacro-iliac symphysis had given way; the ligament over it being torn, and the bones separated sufficiently to admit the handle of a scalpel being received between them.

Blood was found extravasated in the pelvis behind the peritoneum.

I have known three instances of recovery from simple fracture of the os innominatum: two of these were fractures of the ilium, and the nature of the accident was easily detected by the crepitus which was perceived upon moving the crista of the ilium; the third case was a fracture at the junction of the ramus of the ischium and pubes. In the two first a circular roller was applied upon the pelvis, and the patient was freely bled: but in the latter no bandage was employed. I have also known a compound fracture of the os innominatum, recover; but Mr. Hulbert, surgeon, sent me a compound fracture of the ilium, which had proved fatal.

Several cases have also occurred within my knowledge of fracture of the pubes, near its symphysis, accompanied with laceration of the bladder, each of which proved destructive; but when the bones have been broken without injury to the bladder, the patients

have recovered*. The bladder is burst or not, in this accident, according to its state of distension or emptiness at the moment of the accident; for, if empty, it escapes injury.

FRACTURES OF THE UPPER PART OF THE THIGH-BONE.

Before I enter into a description of the dislocations of other joints, it will be proper to point out the fractures incident to the upper part of the thigh-bone, as it is essentially necessary that these accidents should not be confounded with dislocations, or with each other; a mistake which has but too frequently happened. Indeed, it must be confessed, that their discriminating marks are sometimes with difficulty detected, and that the different species of fracture are likewise frequently confounded; for three distinct species, very different in their nature and in their result, have been described and classed under the indiscriminate appellation of fracture of the neck of the thigh-bone. Hence has arisen that difference of opinion, which has led to much discussion respecting the processes which nature employs for their cure, and which less hypothetical reasoning, and more attention to the development of such accidents by dissection, would have been the means of preventing. Whilst one surgeon asserts that all attempts to cure them are unavailing, another maintains that they admit of union like fractures of other bones; which latter opinion is only true as far as regards two species of these fractures.

I shall now, therefore, proceed to state the results of my observations in living persons who have been the subjects of these accidents; of my examination of the dead body; and of some experiments upon inferior animals, which illustrate this subject.

These accidents are more frequent than dislocations of the thigh-

* There is at this time (Sept. 1823), a case in Guy's Hospital, in which the bladder is believed to be ruptured below the reflection of the peritonæum, and between it and the pubes, and the man appears to be recovering by wearing a catheter. But in cases where the injury is above the line of reflection of the peritonæum, the urine escapes into the cavity of the abdomen, and excites great inflammation.

bone ; for, whilst there are received into the hospitals of Guy's and St. Thomas's, (containing about nine hundred persons,) not more upon an average than two such dislocations in a year, the wards are seldom without an example of fracture of the upper part of the thigh-bone.

DIFFERENT SPECIES OF FRACTURE OF THE UPPER PART OF THE THIGH-BONE.

The different species of fracture of the upper part of the thigh-bone, as already observed, are three in number.

First : That in which the fracture happens through the neck of the bone entirely within the capsular ligament.

Secondly : A fracture external to the ligament, through the neck of the thigh-bone at its junction with the trochanter major ; by which the trochanter is split, and the neck of the thigh-bone is received into its cancelli.

Thirdly : A fracture through the trochanter major, beyond its junction with the cervix femoris.

FRACTURES OF THE NECK OF THE THIGH-BONE, WITHIN THE CAPSULAR LIGAMENT.

The appearances which are produced by this fracture are as fol- low :—The leg becomes from one to two inches shorter than the other ; for the connection of the trochanter major with the head of the bone, by means of the cervix, being destroyed by the fracture, the trochanter is drawn up by the muscles as high as the ligament will permit, and consequently rests upon the edge of the acetabulum, and upon the ilium above it. The difference in the length of the limbs is best observed by desiring the patient to place himself in the recumbent posture on his back, when, by comparing the malleoli, it will be generally found that one leg is shorter than the other. The usual state of the limb is, that the heel on the injured side rests in the hollow between the malleolus internus and tendo achillis of the other leg ; but there is some variety in this respect ; a fork is sometimes formed in the trochanter minor, which

Appearance.

Difference in length.

catches the neck of the bone, and prevents a greater ascent than half an inch. Mr. Brodie informed me that he dissected a case in which the cervix was obliquely broken, and in which the upper part of the bone prevented the ascent of the lower. On the other hand, when the fracture has happened for a length of time, and the patient has borne upon the injured limb, the ligament becomes extended, and the leg is shortened four inches: of this Mr. Langstaff mentioned to me an instance in a man of the name of Campbell, aged eighty-two, in whom the heel was obliged to be elevated four inches to make the bearing of the limbs equal. I saw the fractured parts in this man, and the shoe he wore, which entirely verified Mr. Langstaff's statement. The retraction is at first easily removed by drawing down the shortened limb, when it will appear of the same length with the other; but immediately this extension is abandoned, and the patient exerts himself, the muscles draw it into its former position; and this appearance may be repeatedly produced by extending the limb. This evidence of the nature of the accident continues until the muscles acquire a fixed contraction, which enables them to resist an extension, unless it be of a powerful kind.

Foot turned
outwards.

Another circumstance which marks the nature of this injury is, the eversion of the foot and knee; and this state depends upon the numerous and strong external rotatory muscles of the hip-joint, which proceed from the pelvis to be inserted into the thigh-bone, and to which very feeble antagonists are provided: the obturatores, the pyriformis, the gemini and quadratus, the pectinalis and triceps, all assist in rolling the thigh-bone outwards; whilst a part of the glutæus medius and minimus, and the tensor vaginæ femoris, are the principal agents of rotation inwards. It has been denied that this eversion is caused by the muscles, and it has been attributed to the mere weight of the limb; but any one may satisfy himself that it arises chiefly from the muscles, by feeling the resistance which is made to any attempt at rotation of the thigh inwards. This difficulty is also in some measure attributable to the length of the cervix femoris, which remains attached to the

trochanter major ; because in proportion to its length, by resting against the ilium, the trochanter is prevented from turning forwards.

Directly that the bed-clothes are removed, two circumstances strongly arrest the attention of the surgeon : namely, the diminished length of the injured limb, and the eversion of the foot and knee. In the dislocation upwards, the head and neck of the bone prevent the trochanter from being drawn backwards, whilst the broken and shortened neck of the thigh-bone, in fracture of this part, readily admits it ; and hence the reason that the foot is inverted in luxation, and everted in fracture. It is, however, proper to state, that an exception to this rule does now and then exist, and that the limb is found inverted ; but it is of extremely rare occurrence. Several hours must elapse before this eversion assumes its most decisive character, as the muscles require some time to assume a determined contraction ; and this is the reason why the injury has been mistaken for dislocation on the dorsum ilii. The surgeon having been called soon after the accident has happened, before the muscles had acquired that state of contraction to which they are liable, has been led to mistake the nature of the injury, because the foot is not so decidedly everted as it afterwards becomes ; and for this reason patients, even in hospital practice, have been exposed to useless and painful extensions.

In fractures of the neck of the bone within the ligament, the patient, when perfectly at rest in the horizontal posture, suffers but little ; but any attempt at rotation is attended with some pain, because the broken extremity of the bone then rubs against the inner surface of the capsular ligament, upon which it is drawn by the action of the muscles. The pain is felt in this accident in the upper and inner part of the thigh, opposite to the insertion of the iliacus and psoas muscles into the trochanter minor, or sometimes just below this point.

Degree of pain.

The perfect extension of the thigh may be easily effected, but flexion is more difficult, and somewhat painful ; and its degree depends upon the direction in which the limb is bent ; if the

Degree of motion.

flexion be outwards, it is accomplished with but little comparative suffering ; but if the thigh be directed towards the pubes, the act of bending the limb is with difficulty accomplished, and is attended with greater pain ; for the movement is easier or more difficult, in proportion as the neck of the bone is shorter or longer.

Situation of
the trochanter
major.

In this accident the trochanter major is drawn up towards the ilium, but the broken neck of the bone attached to the trochanter is placed nearer the spine of the ilium than the trochanter itself, in which situation it afterwards remains ; and this alteration of position makes the trochanter project less on the injured side, because it is no longer supported by the neck of the bone, as in its natural state, but rests in close apposition with the edge of the acetabulum, and is, consequently, much more concealed than usual, until the muscles waste from the duration of the injury, when the trochanter can be distinctly felt upon the dorsum ilii ; but there will be a greater or less projection according to the length of the fractured cervix attached.

Appearance
in the erect
position.

If doubt exists of the nature of the accident, let the patient be directed to stand by his bed-side, supported by an assistant, and to bear his weight upon the sound limb ; the surgeon then observes the shortened state of the injured leg ; the toes rest upon the ground, but the heel does not reach it ; the knee and foot are everted ; and the prominence of the hip is diminished. The least attempt to bear upon the injured limb is productive of pain, which seems to be occasioned by the tension of the psoas, iliacus, and obturator externus muscles in the attempt, as well as by the pressure of the broken neck of the bone against the interior surface of the capsular ligament.

Crepitus.

A crepitus like that which accompanies other fractures might be expected to occur in this accident, but it is not discoverable when the patient rests on his back with the limb shortened ; if, however, the leg be drawn down, so as to bring the limbs to the same length, and rotation be then performed, the crepitus will be observed, as the broken ends of the bone are thus brought into contact : but the rotation inwards most easily detects the fracture. When the

patient is standing on the sound leg, with the fractured limb unsupported, by rotating it inwards, the crepitus will sometimes be perceived, as the weight of the limb brings the broken bones nearer in apposition.

Women are much more liable to this species of fracture than men: we rarely in our hospitals observe it in the latter, but our wards are seldom without an example of it in the aged female. The more horizontal position of the neck of the bone, and the comparative feebleness of the female constitution, are the probable reasons of this peculiarity. More frequent in women.

To the circumstances I have already mentioned, as strongly characterizing this accident, must be added the period of life at which it usually occurs; for the fracture of the neck of the thigh-bone within the capsular ligament, seldom happens but at an advanced period of life, whilst the other fractures which I have to describe, happen at all periods; and hence has arisen the great confusion with respect to the nature of this injury; for we find that surgeons of the highest character have confounded fractures external to the capsular ligament with those which are within the articulation; and mention the latter as occurring at a period of life in which they scarcely ever happen*. It has been also said, that in early life these bones will readily unite; an assertion which I notice only to shew the confusion which has arisen on this subject. Age.

Old age, however, is a very indefinite term; for in some it is as strongly marked at sixty, as in others at eighty years. That regular decay of nature which is called old age, is attended with changes which are easily detected in the dead body; and one of the principal of these is found in the bones, for they become thin in their shell, and spongy in their texture. The process of absorption and deposition varies at different periods of life; in youth the arteries, which are the builders of the body, deposit more than the absorbents remove, and hence is derived the great source of its Changes in bone occasioned by age.

* I allude particularly to Dessault.

Effects of absorption and diminished arterial action.

growth. In the middle period of life the arteries and absorbents preserve an equilibrium of action, so that, with a due portion of exercise, the body remains stationary; whilst in old age the balance is destroyed, because the arteries act less than the absorbents, and hence the person becomes diminished in weight; but more from a diminution of the arterial than from an increase of the absorbent action. This is well seen in the natural changes of the bones, their increase in youth, their bulk, weight, and little comparative change during the adult period, and the lightness and softness they acquire in the more advanced stages of life; hence the bones of old persons may be cut with a pen-knife, which is incapable of making any impression on those of adults. Even the neck of the thigh-bone in aged persons is sometimes undergoing an interstitial absorption, by which it becomes shortened, altered in its angle with the shaft of the bone, and so changed in its form as to give an idea, upon a superficial view, that it has been the subject of fracture, thus leading persons into the erroneous supposition, that the bone has been partially broken and reunited; but it requires very little knowledge of anatomy to distinguish, in the skeleton, the bone of advanced age from that of the middle period of life.

Age at which it occurs.

The age at which fractures of the neck of the thigh-bone within the capsular ligament generally occur, is a most important consideration; and as it is one on which the practice to be pursued by the surgeon very much depends, I shall take the liberty of making the following statement.

I have been forty years at St. Thomas's and Guy's Hospitals; and, for thirty years, have had more than my share, and much more than I merited, of the practice of London. We have eight hundred and fifty patients in the two hospitals; and I believe that in the two hospitals, eight cases of fractures of the upper part of the thigh-bone occur in each year; but in order to avoid exceeding the average number, I will consider them only as five per annum: thirty-nine multiplied by five, produce one hundred and ninety-five; add to these one case only in each year, in my private prac-

tice of thirty years, they will collectively amount to two hundred and twenty-five cases. Now in that time, I have only known *two cases* of fracture of the neck of the thigh-bone within the capsular ligament *occur under fifty years of age*: one was in a patient aged thirty-eight, who had an aneurism of the iliac artery; and the other has been kindly shewn to me by that excellent anatomist Mr. Herbert Mayo.

This fracture, then, rarely occurs under fifty years of age; and dislocation seldom at a more advanced period, although there are exceptions to this rule: for I have myself once seen the fracture at thirty-eight years of age, but it was very oblique; and a dislocation of the thigh at sixty-two: but the period of life between fifty and eighty years is that at which the fracture most usually occurs; for from the different state of the bone, the same violence which would produce dislocation in the adult, occasions fracture in old age. But when dislocation does occur between the age of sixty and seventy, it is in persons whose constitutions are particularly strong, and in whom age has not produced those changes in the bones which I have endeavoured already to point out.

That this state of bone in old age tends much to the production of fractures, is shewn by the slight causes which often occasion them. In London, the accident most frequently occurs when persons, walking on the edge of the elevated foot-path, slip upon the carriage pavement; though the descent be only a few inches, yet, being sudden and unexpected, and the force acting perpendicularly, with the advantage of a lever in the cervix, it produces a fracture of the neck of the thigh-bone; and as a fall is the consequence, the fracture is imputed, by ignorant persons, to the fall, and not to its true cause. Other trivial accidents may occasion the misfortune. I was informed by a person who had sustained a fracture of this kind, that being at her counter, and suddenly turning to a drawer behind her, some projection in the floor caught her foot; and preventing its turning with the body, the neck of the thigh-bone became fractured. A fall upon the trochanter major will also produce it. But I have dwelt particularly on the *slight*

Slight cause
producing this
fracture.

causes by which it is occasioned, that the young surgeon may be upon his guard respecting it, as he might otherwise believe that an injury of such importance could scarcely be the result of a slight accident, and that excessive violence is necessary to break the neck of the thigh-bone : such an opinion is as liable to be injurious to his reputation, as the error of confounding this accident with dislocation.

Union of this fracture.

Much difference of opinion has existed upon the subject of the union of the fractured neck of the thigh-bone : it has been asserted, that these fractures unite like those of other parts of the body ; but the dissections which I made in early life, and the opportunities I have since had of confirming my observations have convinced me, that fractures of the neck of the thigh-bone,—those of the patella—olecranon,—and condyles of the os humeri,—and that of the coronoid process of the ulna, *generally* unite by ligament, and not by bone. This principle I have taught in my lectures for thirty years ; and it is a most essential point, as it affects the reputation of the surgeon. I was called to a case of this fracture, in which the medical attendant had been promising, week after week, a union of the fracture, and the restoration of a sound and useful limb. After many weeks, the patient became anxious for further advice : I did all in my power to lessen the erroneous impression which had been made by telling the patient that she might ultimately walk, although with some lameness : and taking the surgeon into another room, asked him upon what grounds he was led to suppose there would be union ? to which he replied, he was not aware but that the fracture of the neck of the thigh-bone would unite like those of other bones of the body. The case, however, proved unfortunate for his character, as the patient did not recover in the usual degree.

Young medical men find it so much easier a task to speculate than to observe, that they are too apt to be pleased with some sweeping theory, which saves them the trouble of observing the processes of nature ; and they have afterwards, when they embark in their professional practice, not only every thing still

to learn, but also to abandon those false impressions which hypothesis is sure to create. Nothing is known in our profession by guess; and I do not believe, that from the first dawn of medical science to the present moment, a single correct idea has ever emanated from conjecture. It is right, therefore, that those who are studying their profession, should be aware that there is no short road to knowledge; that observations on the diseased living, examinations of the dead, and experiments upon living animals, are the only sources of true knowledge; and that inductions from these are the sole basis of legitimate theory.

In all the examinations which I have made of transverse fractures of the cervix femoris entirely within the capsular ligament, I have never met with one in which a bony union had taken place, or which did not admit of a motion of one bone upon the other. To deny the possibility of this union, and to maintain that no exception to the general rule can take place, would be presumptuous; especially when we consider the varieties of direction in which a fracture may occur, and the degree of violence by which it may have been produced: as for example, when the fracture is through the head of the bone*, and there is no separation of the fractured ends; or, when the bone is broken without its periosteum being torn; or, when it is broken obliquely, partly within and partly externally to the capsular ligament: but I wish to be understood to say, that if ever it does happen, it is of extremely rare occurrence,

* Some pains have been taken to impress the public mind with the idea, that I have in this work denied the possibility of union of the fracture of the neck of the thigh-bone; and therefore I beg at once to be understood, that I believe the reason why fractures of the neck of the thigh-bone do not unite is, that the ligamentous sheath and periosteum of the neck of the bone is torn through; and that there is, in consequence of this circumstance, a want of nourishment of the head of the bone. But if a fracture should happen without the reflected ligament being torn, I can readily believe that as the nutrition would continue, the bone might unite. But the character of the accident would differ: the nature of the injury could scarcely be discerned, and the patient's bone would unite with little attention on the part of the surgeon.

and that I have not yet met with a single decisive example of it*. As a proof that the general principle which I have stated is correct, I subjoin the following account of forty-three cases, from different collections, of non-union by bone, in fractures of the neck of the thigh-bone.

In the collection at St. Thomas's	.	.	.	7 specimens.
In the College of Surgeons	.	.	.	1 ditto.
In St. Bartholomew's	.	.	.	6 ditto.
At Dublin	.	.	.	12 ditto.
In Mr. Langstaff's, of Basinghall-street	.	.	.	6 ditto.
In Mr. Bell's and Mr. Shaw's	.	.	.	6 ditto.
In Mr. Brookes's	.	.	.	2 ditto.
In Dr. Monro's	.	.	.	2 ditto.
Mr. Mayo's collection	.	.	.	1 ditto.
				—
Total				43

To these I have to add another, from an experiment upon a living animal; while, on the contrary, only a single instance meriting a moment's attention has yet been produced: in this case, the same appearances were found in both the thigh-bones; and even these resembled what I have several times observed in the dead body, arising from a softened state of the bones. I have given a plate of some of these appearances, and the preparations I shall at all times be happy to shew to any of my professional brethren who may wish to see them.

Cause of the
want of union.

Having thus explained the ordinary result of these cases, in relation to their want of union, I shall now proceed to state the reasons which may be assigned for the absence of ossific union in the transverse fracture of the neck of the thigh-bone within the capsular ligament.

Want of proper
apposition.

The first reason is the want of proper apposition of the bones:

* In Mr. Cross's account of his visit to the French hospitals, some interesting matter upon this subject will be found.

for if their broken extremities in any part of the body be kept much asunder, ossific union is prevented.

In a boy, who had a compound fracture of the tibia, without the fibula being broken *, and who had the protruded end sawn off, the two extremities were prevented from coming in contact by the fibula, and union never occurred. My friend, Mr. Smith, an excellent surgeon, at Bristol, had a similar case under his care, in which a portion of the tibia having been sawn off, the fibula, remaining whole, prevented ossific union †.

This fact is easily seen by experiments on animals. I sawed seven-eighths of an inch of the radius from a rabbit, and the ends of the bones were not united to each other, but only to the ulna. I also sawed off the extremity of the os calcis, and suffered it to be drawn up by the action of the gastrocnemius muscle; and it united only by ligament.

The neck of the thigh-bone when broken, is placed under similar circumstances; for, by the contraction of the muscles, it is no longer in apposition with the head of the bone, and is, therefore, prevented from uniting: if this, however, were the only obstacle, it would be argued that the retraction of the thigh-bone might be prevented by bandaging and extension,—the truth of

* If the fibula be broken, large pieces of the tibia will separate, and yet ossific union will ensue.

† The particulars of the case were as follow :—The boy was admitted into the Bristol Infirmary for disease of the tibia; and the diseased portion not exceeding more than from two to three inches in length, that part of the bone was removed by a saw. In a month the limb had acquired so much firmness, that the boy was permitted to walk about the ward, which he was able to perform tolerably well; and in six weeks no doubt was entertained that ossification had taken place in the uniting substance; at this time he sickened with the small pox and died. Upon examination, the edges of the extremities of the tibia were found absorbed and rounded; and on the inferior portion, a bony callus had formed, about three quarters of an inch in extent; no ossific matter was discoverable in the greater part of the space originally occupied by the diseased bone; but a tough, though thin ligamentous band extended from the superior to the inferior portion of the tibia.—See *Medical Records and Researches*.

which cannot be denied ; but it is scarcely possible, even for a few hours, to preserve the limb in exact apposition, as the patient, on the slightest change of posture, produces instant retraction, by bringing into action those powerful muscles, which pass from the pelvis to the thigh-bone.

So in fractures of the patella, although we often do all in our power to prevent retraction of the muscles, yet it very rarely happens that we are able to support a complete approximation of the bones.

Absence of continued pressure.

The second circumstance which prevents a bony union in these fractures is the want of pressure of one bone upon the other even if the length of the limb were preserved : and this will operate in preventing an ossific union in cases where the capsular ligament is not torn ; and in all those which I have had an opportunity of examining, it has not been lacerated. The circumstance to which I allude proceeds from the secretion of a quantity of fluid into the joint ; from the increased determination of blood to the capsular ligament and synovial membrane ; a superabundance of serous synovia,—that is, synovia much less mucilaginous than usual,—which extends the ligament, and thus entirely prevents the contact of the bones, by pushing the upper end of the body of the thigh-bone from the acetabulum. After a time this fluid becomes absorbed, but not until the inflammatory process has ceased, and ligamentous matter has been effused into the joint from the interior of the synovial surface. The muscles, also, do not in this accident produce pressure between the broken extremities of bones, which so greatly conduces to the union of other fractures ; for if two broken bones overlap each other, on that side on which they are pressed together, there is an abundant ossific deposit ; but on the opposite side, where there is no pressure, scarcely any change is observed. So also we find that, if the ends of the bones be drawn from each other by the action of muscles, as sometimes happens in the fractures of the os femoris, tibia, os humeri, radius and ulna, union is not effected until the surgeon, by a strong leathern bandage tightly buckled around the limb, compels the

bones to press upon each other, and thus support the necessary inflammation for the production of ossific union. When a fracture occurs amidst muscles, those which are inserted into the fractured part of the bone, have generally a tendency to keep the extremities of the bones together, with some few exceptions; but when a fracture occurs in the neck of the thigh-bone, the muscles have only an influence upon one portion of the fractured bone; and this influence serves to draw one part from the other.

But the third and principal reason which may be assigned for the want of union in this fracture is, the almost entire absence of ossific action in the head of the thigh-bone when separated from its cervix; its life being supported by the ligamentum teres, which has only a few minute vessels, ramifying from it to the head of the bone. The structure of the neck of the thigh-bone, and of the parts surrounding it, is explained in the account of the anatomical plate connected with this part of my subject. But here it may be observed, that the neck and head of the thigh-bone are naturally supplied with blood by the periosteum of the cervix, and that when the bone is fractured, if, as most frequently happens, the periosteum be torn through, the means of ossific action are, in consequence of such fracture and laceration, necessarily destroyed in the head of the bone. Scarcely any change, therefore, takes place in the head or neck of the bone attached to it; no deposit of cartilage or bone, similar to that of the other fractured bones, is produced; but the deposit which does take place, as will be seen in the plates of fracture of the neck of the thigh-bone, consists of ligamentous matter, covering the surface of the cancellated structure with little patches like ivory on the head of the bone*.

Little action in the head of the bone.

* But if I attempt to prevent union in a fracture external to a joint, I find, by moving the bone from time to time, that in proportion to that motion is the quantity of callus produced; which is just the reverse in the accidents I am now describing.

Dissection of
this fracture.

The appearances which are found on the dissection of these injuries are as follow:—The head of the bone remains in the acetabulum attached to the ligamentum teres. There are, upon parts of the head of the bone, very small white spots like ivory. The cervix is sometimes broken directly transversely, at others with obliquity. The cancellated structure of the broken surface of the head of the bone and of the cervix, is hollowed by the occasional pressure of the neck attached to the trochanter, and consequent absorption; and this surface is sometimes partially coated with a ligamento-cartilaginous deposit. The cancelli are rendered firm and smooth by friction, as we see in other bones which rub upon each other when their articular cartilages are absorbed. Portions of bone are formed or broken off, and these are found either attached by means of ligament, or floating loosely in the joint, covered by a ligamentous matter; but the pieces do not act as extraneous bodies, so as to excite inflammation, and thus produce their discharge, any more than those loosened portions of bone covered by cartilage, which are found so frequently in the knee, and sometimes in the hip and elbow-joints. With respect to the neck of the bone which remains attached to the trochanter major, the most remarkable circumstance is, that it soon becomes in a great degree absorbed, only a small portion of it remaining; its surface is yellow, and extremely smooth, if the bones have rubbed against each other. Some ossific deposition I have seen manifested around this small remaining part of the neck of the bone, and upon the trochanter major and thigh-bone below it, in several examples of this fracture. We do not, however, observe the same process of union as in other bones, but a ligamentous instead of an ossific union.

Ligament and
synovial mem-
brane.

The capsular ligament enclosing the head and neck of the bone becomes much thicker than natural, but the synovial membrane undergoes the greatest change from inflammation, being very much thickened, not only upon the capsular ligament, but also upon the reflected portion of that ligament upon the neck of the bone, as far as the edge of the fracture.

Within the articulation is found a large quantity of serous synovia; by which term I mean to express, that the synovia is less mucilaginous, and contains more serum than usual, mixed with a small quantity of blood; this fluid, by gradually extending the ligament, separates for a time one portion of bone from the other: it is produced by the inflammatory process, and becomes absorbed when the irritation in the part subsides. I do not know the exact period at which this change takes place, but I have seen it in the recent state of the injury. Into this fluid is poured a quantity of ligamentous matter, by the adhesive inflammation excited in the synovial membrane, and flakes of it are found proceeding from its internal surface, uniting it to the edge of the head of the bone. Thus the cavity of the joint becomes distended, in part by an increased secretion of synovia, and in part by the solid effusion which the adhesive inflammation produces; the membrane reflected on the cervix femoris is sometimes separated from the fractured portions, so as to form a band for the fractured edge of the cervix to that of the head of the bone: bands also of ligamentous matter pass from the cancellated structure of the cervix to the head of the bone, serving to unite, by this flexible material, the one broken portion of bone with the other.

Effusion into the joint.

New ligament.

Union by ligament.

The trochanter is drawn up, more or less, in different accidents; and in those cases in which it is very much elevated, I have known a considerable ossific deposit take place upon the body of the thigh-bone, between the trochanter major and the trochanter minor. When the bone has been macerated, its head is much lighter, and more spongy than in the healthy state, excepting on those parts most exposed to friction, where it is rendered smooth by the attrition, which gives it a polished surface.

Appearances on dissection.

These, then, are the usual appearances on dissection: there are, however, two preparations in the Royal College of Surgeons in London, which have been sent as specimens of union by bone of the cervix femoris; but as I may be thought prejudiced in favour of the opinion I have advanced, I shall give that of an excellent anatomist whose loss we have had lately to deplore. Mr. Wilson

Specimens in the college.

says, "*I have examined very attentively these two preparations, and cannot perceive one decisive proof in either, of the bones having been actually fractured.*"

Want of ossific union not peculiar to the femur.

This circumstance of want of ossific union, is not peculiar to the neck of the femur, as will be seen in our account of fracture of the condyles of the os humeri, of the coronoid process of the ulna, and of bones generally, when seated within the capsular ligament.

All nature's efforts at ossific union end in callosus or ligament.

It appears then, as a general principle, from the account which I have given of the dissection of those whose bodies have been examined after having suffered from this fracture, that ossific union is not produced; that nature makes slight attempts for its production upon the neck of the bone, and upon the trochanter major, but scarcely any upon the head of the bone: and that if union be produced, it is by means of ligament.

Mr. Stanley, for whom, both as an anatomist and surgeon, I have great respect, has met with the appearance of fracture in the neck of each thigh-bone, in the same subject. I do not mean to deny the possibility of the necks of both thigh-bones in this subject having been fractured, because that point can only be determined by the history of the accident, and by a very careful and accurate examination of several sections of the bones; but I can shew that similar effects are produced by disease.

Structure of the bone.

The neck of the thigh-bone in adult persons of middle age, has a close cancellated structure, with considerable thickness of the shell which covers it; but in old subjects, the cancellated structure of the shaft of the bone, which is formed of a coarse net-work, loaded with adipose matter, is often extended into the neck of the bone, and the shell which covers it becomes so thin, that when a section is made through the middle of the head and cervix it is found diaphanous: of this I have several specimens. As the shell becomes thin, ossific matter is deposited on the upper side of the cervix, opposite the edge of the acetabulum, and often a similar portion at its lower part, and thus the strength of the bone is in some degree preserved: this state may be

frequently seen in very old persons. Mr. Steel, of Berkhamstead, an intelligent surgeon, and a most respectable man, gave me the thigh-bone of a person thus altered, whose age was ninety-three.

When the absorption of the neck proceeds faster than the deposit on its surface, the bone breaks from the slightest causes, and this deposit wears so much the appearance of an united fracture, that it might be easily mistaken for it. Before the bone thus alters, we sometimes meet with a remarkable buttress shooting up from the shaft of the bone into its head, giving it additional support to that which it receives from the deposit of bone upon its external surface. But another change is also produced from disease, of which the following is the history, and which directly applies to the subject before us.

Absorption and deposition.

Old bed-ridden and fat persons (generally females) are often brought into our dissecting-room with some of their bones broken (and more frequently the thigh-bone than any other) in being removed from the grave. If the cervix femoris of such persons be examined, it will be found that the head of the bone is sunk down upon its shaft, and that the neck of the thigh-bone is shortened, so that its head is in contact with the shaft of the bone, opposite to the trochanter minor; and at the part at which the ligament is inserted into the neck of the bone, the phosphate of lime is absorbed, and a ligamento-cartilaginous substance occupies its place; either extending entirely through the neck of the bone, or partially, so that one section exhibits signs of it, and in another it is wanting. The bone, in some cases, is so soft and fragile, both in its trochanter and head, that it will scarcely bear the slightest handling; and the motion of the thigh-bones in the acetabulum is almost entirely lost, so that the persons must have had little use in their lower extremities.

During the last winter we had two instances of this alteration in the neck of the bone, and it is an appearance which I have several times seen.

In examining the body of an old subject, very much loaded with

fat, in the dissecting-room of St. Thomas's Hospital, I found that the gentleman who had dissected one limb, had cut through the capsular ligament of the hip-joint, and tried to remove the head of the thigh-bone from the acetabulum; but the neck of the bone broke on the employment of a very slight force, and upon a further trial to remove it, the bone crumbled under his fingers. As the other limb was not yet dissected, I requested Mr. South, one of our demonstrators, to remove with care the upper part of the thigh-bone; but although he used great caution in doing it, he could not remove the bone without fracturing the upper part of its shaft; but he succeeded in removing the upper part of the bone, so that it might be preserved.

We have here, then, a case in which the neck of the bone was absorbed, so that the head was brought in contact with the trochanter; in which, most decidedly, there had not been a fracture, although it had in some parts the appearance of one; and in which the disease occurred in each hip-joint.

Another case of the same kind was examined by Mr. South, during the last winter, which, so far as it relates to the softened state of the upper part of the thigh-bone, was similar to the former; the heads were spongy, the necks were shortened, so that there was scarcely any remaining; each trochanter was light in weight, spongy, and very large; and there was little if any motion in either of the hip-joints; so that both limbs appeared, at first sight, as if dislocated upon the pubes.

But the best specimen of this state of the bone is the following, which I preserve with the most assiduous care, and value in the highest possible degree: I have had for twenty years in the collection of St. Thomas's Hospital, the thigh-bone of an old person, in which the head of the bone had sunken towards its shaft. I have been in the habit of shewing this bone twice a year as a specimen how bones sometimes become soft from age and disease, and from the absorption of their phosphate of lime; and I have frequently cut with a penknife both its head and its condyles to shew this softened state. On sawing through its cervix, the cartilage, deprived

phosphate of lime, had dried away in several parts, and the appearance was such that a person, ignorant of the change, would have declared it to be a fracture ; only, that in some sections the cartilage had taken different directions, and in some the bone was yet entirely absorbed. There is also in the Museum of St. Thomas's Hospital, a skeleton in which both the thigh-bones, and the os humeri, are, in a subject extremely altered by rickets, covered by similar portions of cartilage, in which no ossific matter exists.

I have been led to prosecute the inquiry by experiments upon animals. I found it difficult to succeed in breaking the bone in the direction I wished, and, after a great number of experiments, successful only in the following instances ; the preparations of which I have preserved, and they may be seen in the Museum at St. Thomas's Hospital.

Experiment I.

The neck of the thigh-bone was fractured in a rabbit, on October 1, 1818; and on December 1st, 1818, as the wound had been some time healed, I dissected the animal.

Appearance on dissection.—The capsular ligament was much weakened; the head of the bone was entirely disunited from the neck, but adhered by a new ligamentous substance to the capsular ligament; the broken cervix, which was very much weakened, played on the head of the bone, and had smoothed by attrition; the head of the thigh-bone had not undergone any ossific change.

Experiment II.

The neck of the thigh-bone was broken in a dog, November 1, 1818, and the animal was killed on the 14th of December following.

Dissection.—The trochanter was much drawn up by the action of the muscles, so that the head and cervix femoris were not

in apposition. The capsular ligament was much thickened, and contained a large quantity of synovia.

The joint was lined with adhesive matter of a ligamentous appearance adhering to the head of the bone, which did not seem to be changed by any ossific process; but the thigh-bone around the capsular ligament, the trochanter major, and the bone a little below it were enlarged.

We find, therefore, by these dissections, that what appears in the human subject after this accident, takes place also in other animals; and that motion, want of apposition and pressure, with the little ossific action in the head of the bone, under these circumstances, produce a deficiency of bony union, as in man.

The two preparations which I have preserved, were the only examples in which the experiment was complete in relation to the transverse fracture; but I have two other interesting preparations derived from these experiments. I also made a great number of others, in which the fractures continued compound; in each of these the head of the bone either became absorbed, or was discharged by ulceration; and I never could succeed in uniting the head to the neck of the bone. I have since divided the neck of the thigh-bone in a dog, and the head of the bone was three-fourths absorbed. By way of contrast, I have also divided the bone externally to the capsule, in five instances, and have preserved the bones: the wounds united by adhesion, and every bone has been healed by ossific union: the natural inference is, that fractures within the capsule are not at all susceptible of union by bone, but that fractures external to it are so, readily. As to the notion that the bearing upon the limb, or its weight, may have influence to prevent union in these animals, I have only to observe, that the muscles become contracted, the limb is drawn up, and the animal cannot bear upon it for several weeks.

My friend, Mr. Brodie, has furnished me with the following

count of an experiment which he made upon the same subject, which fully confirms my observations.

“ Dear Sir :—The circumstances of the experiment which I mentioned, were briefly these,—The tibia of a guinea-pig was broken at the lower end. A month afterwards the animal was killed. On dissection, I found a fracture extending across the tibia, transversely, and so close to the ankle-joint, that it was situated at that part of the bone which is covered by the reflected layer of the synovial membrane. The synovial membrane itself, and the ligaments of the joint, appeared to have been very little injured, and the broken surfaces had remained in good apposition ; nevertheless, there was not the smallest union of them, either by bone or ligament, and there had been no formation of callus round the fracture. The bone in the neighbourhood of the fracture had become compact and hard, in consequence of the ossification of the medullary membrane lining the cancelli.”

Professor Burns, of Glasgow, has had the great kindness to send me the following observations.

“ Permit me to offer my warmest thanks for the pleasure and edification I have received from the study of your late work. I was early led to attend to the process adopted by nature in forming a new articulation in injuries to the hip-joint, by the dissection of a dog which I had when a boy, and which had the hip fractured. Many years afterwards I examined the parts, and found the fragment of the cervix belonging to the head absorbed, the head itself filling the acetabulum ; the shaft of the bone expanded ; a new head formed for a new socket, and the whole enveloped in a dense capsule or covering.

“ In a fracture of the os femoris external to the capsule, the gluteus medius and minimus seem to act as a cushion to stop the ascent of the end of the cervix, whilst the fragment attached to its head will, perhaps, afford some opposition ; but in the fracture within the capsule, the end of the cervix is drawn more freely up under the gluteus medius, and lodged behind the inferior spinous process of the ilium.

“Is this the explanation of the greater shortening in the one fracture than in the other?”

“Nothing can better explain the want of ossific union than the principle you have laid down.”

Having by experiment verified the result I have mentioned, I was next anxious to learn if the head and neck of the thigh-bone would unite under a longitudinal fracture, partly within and partly external to the capsular ligament, in which apposition, contact and pressure are maintained; and for this purpose I made the following experiment.

Experiment III.

Longitudinal
fracture.

I divided the head, neck, and a portion of the trochanter major of the thigh-bone of a dog longitudinally, by placing a knife on the trochanter major, and striking it down towards the acetabulum through the head of the bone. The animal was killed twenty-nine days after, and the following appearances presented themselves.

A portion of the trochanter major had been broken off, and was only united by cartilage. The head and neck of the bone, which had been longitudinally broken, were united; the neck by a larger quantity of ossific deposit than that which joined the separated portions of the head of the bone, and so irregularly as to make a beautiful preparation, and shew the circumstance most clearly. This bone may be seen in the collection at St. Thomas's Hospital.

Whether the union began in the fracture externally to the ligament, and proceeded inwards, or whether on the whole surface at once, it is impossible to ascertain; but the coalescence was firm; although, as I have stated, I thought more so at the neck than at the head of the bone. The union in this case is readily explained. Apposition was supported; the vessels of the head of the bone and cervix remained whole; and, therefore, this experiment shews at once why the longitudinal unites, and the transverse, in general, does not unite.

Thus then, it appears, that in a longitudinal fracture of the head and neck of the bone *partly external to the ligament*, if the bones be applied to each other, pressed together, and in a state of rest, and the vessels remain, ossific union can be produced; although the ossific deposition is extremely slight when compared with that of other bones. Union of these bones.

The fracture of the neck of the thigh-bone may be confounded with the dislocation of the os femoris upon the dorsum ilii; with that into the ischiatic notch; and with that upon the pubes: as in all these luxations the limb is shorter. From the two former it may be distinguished by the eversion of the foot, and by the mobility of the limb in fracture; and from the latter, by the ball of the os femoris being felt in the groin in the dislocation on the pubes; otherwise the eversion of the foot in both cases might lead to their being confounded. Diagnosis.

With respect to the treatment of fractures of the neck of the thigh-bone within the capsular ligament, various are the means to which I have had recourse, and which I have known resorted to by others, for the purpose of producing union in this accident, but all without avail. Treatment.

One mode consisted in placing the fractured limb over a double inclined plane, thus maintaining a regular and constant extension, which, by raising the planes at the knee, may be increased to any degree that the surgeon may require, or the patient can bear; at the same time, a bandage is applied around the pelvis and upper part of the thigh, to bring the neck of the bone, as much as possible, in approximation with the head from which it has been separated: and this extension, with pressure, has been steadily preserved for three months. With respect to the patient's body, it has been placed at an angle of forty-five degrees.

A second method consisted in placing a board at the foot of the bed, upon which the foot of the sound limb rested, so as to prevent the descent of the body in the bed; the other limb was

then extended as much as possible, and a weight, appended to the foot, was suffered to hang through a hole in the board over the end of the bed, in order to support the extension with regularity and steadiness for several weeks.

In a third method, the patient has been placed in bed with both limbs extended to the utmost possible degree, and then the two feet have been bound together by a roller passed from the foot on the injured side under the sound foot, so as to make one limb steadily preserve the extension of the other. This may also be effected by an iron plate affixed to the shoe on the sound foot, with a screw passed through a hole in the plate, and having a band fixed to the other foot, which may be tightened by turning the screw; and the foot, by this means, be kept constantly extended.

A fourth mode employed for this purpose has been the application of Boyer's splint, with the intention of extending the limb from the pelvis; but this splint, though it answers well for fractures of the thigh under ordinary circumstances, has a tendency to prevent union in those fractures which occur at the upper part of the bone, by the pressure of its band upon the inner and upper portion of the thigh.

Mr. Hagedorn's
machine.

Mr. Hagedorn has recommended a machine for fractures of the neck of the thigh-bone, which is very ingenious in its construction. It consists of a long splint to extend from the hip to the foot, and to be firmly applied, by means of proper straps, to the sound limb; at the bottom of this is fixed a broad foot-board, perforated with a sufficient number of openings to receive the bands, by means of which both feet are to be securely fixed to it; these bandages are attached to a kind of leathern gaiter, made to lace tight round the ankle, and the upper part of the splint is kept close to the hip by means of a broad bandage carried round the pelvis. By this machine the extension of the limb is tolerably well effected, so long as the patient can be kept still; but a displacement of the bones will invariably be the consequence of every motion which

the evacuation of the *fæces* will necessarily require. I am never so wedded to any opinion as to be prevented from trying, or from wishing others to employ, every means which appear plausible or ingenious; and, therefore, I think that this instrument ought to have a fair trial.

Mr. Earle is of opinion, that these cases may be cured by long continued attention in keeping the parts at perfect rest. I think a trial should be made of the bed recommended by Mr. Earle, and heartily wish him success in his laudable attempt to prevent the lameness and shortening of the limb in cases of fracture within the capsule; which has invariably been the result in those cases which I have had an opportunity of observing.

Mr. Earle's
fracture bed.

But all the means which I have seen used have been found unavailing. I have been baffled at every attempt to cure, and have not yet witnessed one single example of union in this fracture. I know that some persons still believe in the possibility of this union, by surgical treatment, and that instances of success have been published; but I cannot give credence to such cases, until I see that the authors were aware of the distinction between fractures within and fractures external to the articulation.

All means un-
availing.

The cases in which union might be produced are two: one, in which the periosteum covering the neck of the thigh-bone is not torn through, a circumstance which now and then happens; the other in which the head of the bone is broken, so that the *cervix* still remains in the acetabulum: but in neither of these cases will the limb exhibit the shortened state which the fracture of the neck of the bone usually produces, and therefore, the common characters of the accident will be wanting. Even in such cases, I would, in consideration of the confinement and danger of bony union, prefer a ligamentous union, as well from regard to the health and life of the person, as, I believe, to the subsequent use of the joint.

Exceptions.

The various attempts at curing these cases having failed, and

Hypothetical
case.

the patient's health having invariably suffered under the trials made to effect union, I should, if I sustained this accident in my own person, direct that a pillow should be placed under the limb throughout its length ; that another should be rolled up under the knee, and that the limb should be thus extended for ten days or a fortnight, until the inflammation and pain had subsided. I should then daily rise and sit in a high chair, in order to prevent a degree of flexion, which would be painful ; and walking with crutches, bear gently on the foot at first ; then, gradually more and more, until the ligament became thickened, and the muscles increased in their power. A high-heeled shoe should be next employed, by which the halt would be much diminished. Our hospital patients treated after this manner, are allowed in a few days to walk with crutches ; after a time a stick is substituted for the crutches, and in a few months they are able to use the limb without any adventitious support.

The degree of recovery in these cases is as follows :—if the patient be very corpulent, the aid of crutches will be for a long time required ; if less bulky a stick only will be sufficient ; and where the weight of the body is inconsiderable, the person will be able to walk without either of these aids, but will drop a little at each step on that side, unless a shoe be worn having a sole of equal thickness to the diminished length of the limb. In every case, however, in which there is the smallest doubt whether it be a fracture within, or external to the ligament, it will be proper to treat the case as if it were the fracture which I shall hereafter describe, and which admits of ossific union.

It is gratifying to find opinions which have been for thirty years delivered in my lectures, confirmed by the observations of intelligent and observing persons ; and, therefore, it is with pleasure that I read in the Dublin Hospital Reports, the account of the dissection of several cases of fracture of the cervix femoris, by my friend Mr. Colles, of Dublin, (a man excellently informed in his profession,) who found in them similar want of ossific union, in the

fracture within the ligament, to that which I have described. A few contributions of a similar kind, from the ardent cultivators of morbid anatomy, would soon prevent persons from being tortured with trials, which have been frequently repeated, and found to be uniformly unavailing.

FRACTURES OF THE CERVIX FEMORIS EXTERNAL TO THE CAPSULAR LIGAMENT, AND INTO THE CANCELLI OF THE TROCHANTER MAJOR.

The symptoms of this accident in some respects resemble those of the fracture within the ligament, and they require much attention to distinguish them accurately; but the result is entirely different; so that a favourable opinion may be given as to the restoration of the bone by an ossific union.

In this accident, the injured leg is shorter than the other by one half to three quarters of an inch; the foot and toe on that side are everted, from the loss of support which the body of the thigh-bone sustains in consequence of the fracture; much pain is felt at the hip, and on the inner and upper part of the thigh; and the joint loses its usual roundness. Symptoms.

The distinguishing signs of this accident are,—First:—It sometimes occurs at the earlier periods of life; for it happens in the young, and in the adult *under fifty years of age*, although I have known it at a later period, when it often proves fatal; but if the above symptoms are seen at any age under fifty years, there will be generally found a fracture external to the capsular ligament, and capable of ossific union. Several cases of these which have fallen under my notice have occurred under that period; and, therefore, a surgeon called to the bed-side of a patient who has an injury to the upper part of the thigh-bone, if he finds the age of the patient to be under fifty years, will, with very few exceptions, be warranted in pronouncing it either a fracture just external to the ligament, or one through the trochanter major. But I also mention that *both fractures occur in age*, and therefore no discrimination can be drawn between the two, in advanced age, but by the most careful examination. Diagnostic marks.
Union of the bone.

degree of diminution in the length of the limb, and his answer was, "If you mention three quarters of an inch, you will state rather more than its degree of retraction, even when all the muscles were contracted to their utmost rigidity." I shall be happy to shew the parts which I removed from the case, with all the surrounding muscles, to any person who wishes to see them, as they at once explain the nature of the accident, and the reason why the limb is so little shortened.

Although, then, this accident has some of the marks of fracture of the neck of the bone within the ligament, yet it unites by bone, and it will be seen that the union is similar to that of other bones external to the joints; cartilage is first deposited, and then the matter of bone, because in this case the parts can be brought into apposition, and the ends of the bones are confined together by the surrounding muscles; one portion is pressed against the other and the neck of the bone sinks deeply into the cancellated structure of the trochanter; thus direct approximation and pressure are preserved when the fracture is at the junction of the cervix with the trochanter, and the nutrition of each extremity of the bone is well supported by the vessels which proceed to it from the surrounding parts.

Difference of
opinion recon-
ciled.

We now see the reason of the difference of opinion respecting the union of fracture of the neck of the thigh-bone. In the internal fracture the bones are not applied to each other, and the nutrition of the head of the bone being imperfect, in general no ossific change is produced; but in the external fracture the bones are held together by the surrounding parts, easily kept in apposition by external pressure, and there is not only ossific union, but very exuberant callus. Much time is required in these accidents to produce a complete ossific union; and the neck of the bone, received into the cancelli, moves for a long period in its new situation; although it is so far locked in as to prevent its separation.


Treatment.

In the treatment of this injury, the principle is, to keep the bones in approximation by pressing the trochanter towards the acetabulum; and the length of the limb is preserved by applying a

roller around the foot of the injured leg, and by binding the feet and ancles firmly together, so as to prevent their retraction, and thus cause the uninjured side to serve as the splint to that which is fractured, giving it a continued support. A broad leathern strap should also be buckled around the pelvis, including the trochanter major, to press the fractured portions of the bone firmly together; and the best position for the limb is, to keep it in a straight line with the body.

The following plan I have also known successful:—The patient being placed on a mattress on his back, the thigh is to be brought over a double inclined plane composed of three boards, one below, which is to reach from the tuberosity of the ischium to the patient's heel, and the two others having a joint in the middle by which the knee may be raised or depressed; a few holes should be made in the board, admitting a peg, which prevents any change in the elevation of the limb but that which the surgeon directs; over these a pillow must be thrown, to place the patient in as easy a position as possible*.

When the limb has been thus extended, a long splint is placed upon the outer side of the thigh to reach above the trochanter major, and the upper part of this is fixed to a strong leathern strap, which buckles around the pelvis, so as to press one portion of bone upon the other; and the lower part of the splint is fixed with a strap around the knee, to prevent its position from being altered; the limb must be kept as steady as possible for many weeks, and the patient may be permitted to rise from his bed when the attempt does not give him much pain: he is still to retain the strap which I have mentioned round the pelvis; and by this treatment he will ultimately recover, with a useful, though shortened limb. Recovery.

* The construction of this inclined plane is so little complicated, that it may be made at the instant, of two common boards, one of which is to be sawn through nearly at the middle, and if hinges cannot be immediately procured, the boards may be nailed together thus .

FRACTURES THROUGH THE TROCHANTER MAJOR.

Oblique fractures sometimes happen through the trochanter major, and the cervix ossis femoris does not participate in the injury. This accident occurs at every period of life, and its symptoms are as follow :—The leg is very little, and sometimes not at all, shorter than the other, and the foot is benumbed ; in some cases the patient is unable to turn in bed without assistance, and the attempt gives him great pain. The broken portion of the trochanter major is, in some cases, drawn forward towards the ilium ; in others, it falls towards the tuberosity of the ischium ; but is, in general, widely separated from that portion which remains connected with the neck of the bone. The foot is greatly everted ; the patient cannot sit, and any attempt to do so produces excessive pain. Crepitus is with difficulty discovered if the trochanter is either much fallen, or much drawn forwards.

Diagnostic marks.

The distinguishing marks of this accident are, a fixed state of the upper part of the trochanter, whilst its lower part obeys the motion of the thigh-bone ; eversion of the foot, and the very perceptible altered position of the trochanter major ; attended with crepitus under very extended motion of the upper part of the limb, and with little diminution of its length.

But when the fracture happens below the insertion of the principal rotatory muscles, the lower portion of bone is much raised by the action of the gluteus maximus, and the limb becomes very much shortened and deformed at the place of union by exuberant callus.

This fracture unites very firmly, and more quickly than when the cervix is broken at the root of the trochanter, and the patient recovers with a very good use of the limb.

Case.

The first case of this kind I ever saw was in St. Thomas's Hospital, about the year 1786. It was supposed to be a fracture of the neck of the thigh-bone within the capsule, and the limb was extended over a pillow rolled under the knee, with splints on

each side of the limb, by Mr. Cline's direction. An ossific union succeeded, with scarcely any deformity, excepting that the foot was somewhat everted, and the man walked extremely well. When he was to be discharged from the hospital a fever attacked him, of which he died; and upon dissection, the fracture was found through the trochanter major, and the bone was united with very little deformity, so that his limb would have been equally useful as before.

In conclusion, I have to observe, that as the diminution of the length of the limb, and its eversion of the knee and foot, are signs common to fractures of the thigh-bone generally, it may be proper to bring into one view the means of distinguishing the three species of fracture which I have described.

The fracture of the cervix within the capsule is known, with very rare exceptions, by the very advanced age of the patient,—by its greater frequency in female than in male subjects,—by the absence of swelling and ecchymosis,—by the elevation and advance of the trochanter,—by the greater mobility of the joint, allowing flexion and extension, although with some pain, and resistance from muscles,—by a crepitus perceptible only on drawing down the limb to the same length with the other, and then rotating it,—by the pain felt at the trochanter minor,—by the small degree of constitutional irritation attending the accident,—by the slight causes which produce it,—and by the little local swelling or change of appearances which ensues.

Fracture within the capsule.

Fractures of the cervix into the cancelli of the trochanter are known by the effusion of blood amidst the muscles,—by great swelling produced, and by ecchymosis, which appears soon after the accident,—by an unnaturally fixed state of the joint, so that flexion and extension cannot be performed,—by excessive pain on the least motion of the hip-joint, and upper part of the thigh-bone,—by a crepitus attending the least motion of the thigh-bone without drawing it down to the length of the other,—and by the inflammation, swelling, and constitutional irritation produced, which are frequently fatal.

Fractures of the cervix into the cancelli.

The fracture of the trochanter major may be easily known by the separation of the bone at the part, so that the finger may be placed between the fractured portions,—by the distinct crepitus felt in putting the fingers on the trochanter when the knee is advanced,—by inability of the upper portion of the trochanter to obey the motions of the lower, and of the shaft of the bone,—and when at the lower part of the trochanter, by great overlapping, distension, and exuberant callus.

Concluding observation.

I have thus stated what dissection and observation have taught me of the three fractures of the upper part of the thigh-bone, and shewn it to be a general principle, that fractures within the capsule do not unite by bone. I ought to add, that, in the Museum of Mr. Langstaff, there is a preparation of fractures within, and of one external to the ligament; the latter firmly united by bone, whilst the former has scarcely undergone any ossific change. I can have no wish but that these fractures within the capsule should unite by bone, if that result be desirable. I only state what dissection has taught me; and with respect to the contrivances to produce their union, I cannot extol them until there be some evidence of their value.

FRACTURE OF THE EPIPHYSIS OF THE TROCHANTER MAJOR.

Mr. Key, surgeon to Guy's Hospital, had the kindness to send me the following account of a peculiar fracture of the trochanter major, in which this process was broken from the thigh-bone at the part at which it is naturally united by cartilage as an epiphysis in youth.

The subject of this accident was a young girl about the age of sixteen, who tripped in crossing the street, and in falling, struck her trochanter violently against the curb-stone. She immediately rose, and without much pain or difficulty walked home. The accident occurred on Saturday, March 15th, 1822; and, in consequence of the increase of pain she experienced on the inner side of the thigh, she presented herself at Guy's for admission on the Thursday following. Her constitutional symptoms being evidently

more violent than those which usually arise from fractured femur, she was placed under the care of the physician, Dr. Bright, at whose request I examined the limb. Her right leg, which was the one injured, was considerably everted, and appeared to be about half an inch longer than the sound limb. It admitted of passive motion in all directions, but in abduction gave her considerable pain. She had perfect command over all the muscles except the rotators inwards. The fact that she had walked both before and since her admission into the hospital, gave rise to some doubts as to the existence of a fracture, and the closest examination of the trochanter and body of the femur, could not detect the slightest crepitus, or displacement of bone. I repeated the examination of the limb on the following day, but the result was equally unsatisfactory.

The fever under which she was labouring, together with general abdominal uneasiness, threatening her life, the limb underwent no further examination. She died on Monday, nine days after the accident.

Examination after death.

Wishing to ascertain (for I suspected some obscure fracture of the os femoris) the exact nature of the injury, previously to removing the soft parts I moved the limb in every direction, fixing the trochanter and head of the bone; but I could perceive no deviation from the usual state of parts, nor could I distinguish the slightest crepitus under all the variety of movements. I should observe, that there was no tumefaction of the thigh, and therefore the trochanter and head of the os femoris were as readily distinguished and exposed to examination as in the most healthy limb.

The capsule of the joint being laid bare, a cavity was discovered by the side of the pectineus, leading backwards and downwards, towards the trochanter minor, and containing some pus: it allowed the fingers to pass behind the bone to the greater trochanter. The head of the bone was then dislocated by cutting through the ligaments, and not till then was a fracture discovered at the root of

the trochanter major. The upper half of the femur being removed from the body, I discovered the reason why the fracture had eluded our search.

The fracture had detached the trochanter from the body and neck of the bone, but without tearing through the tendons attached to the outer side of the process. The tendons are those of the two smaller glutei, and the commencement of that of the vastus externus; had they been torn, the broken portion of bone would have been drawn upwards by the action of the two former muscles, and in that case, the injury would readily have been recognized; but they so effectually prevented all movement of the fractured portion, that, when dissected from the body, not the least motion could be produced except in one direction. It was found that this motion resembled that which would be produced by a hinge; the tendons acting the part of a broad hinge, and allowing the portion to be moved only upwards and downwards. It is evident that such motion could not have been produced by any direction given to the limb; hence it is also manifest, that the fracture could not have been detected during the life of the patient.

FRACTURES BELOW THE TROCHANTER.

The thigh-bone is sometimes broken just below the trochanter major and minor; it is a difficult accident to manage, and miserable distortion is the consequence if it be ill-treated. The end of the broken bone is drawn forwards and upwards, so as to form nearly a right angle with the body, and the cause of this position is evidently the contraction of the iliacus internus and psoas muscles, assisted by the pectinalis, and perhaps by the first head of the triceps. A better idea of the effect of this accident may be obtained by a view of the Plate in my larger work, where the bone will be observed to be united, not only with extreme shortening, but with a hideous projection forwards. If pressure be made upon the projecting bone in the treatment of this case, it only adds to the patient's sufferings, and to the degree of irritation of the limb, without preserving the bone in its proper situation. It will be seen that this

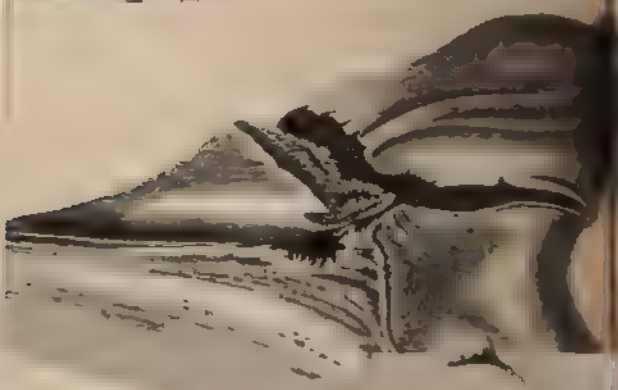
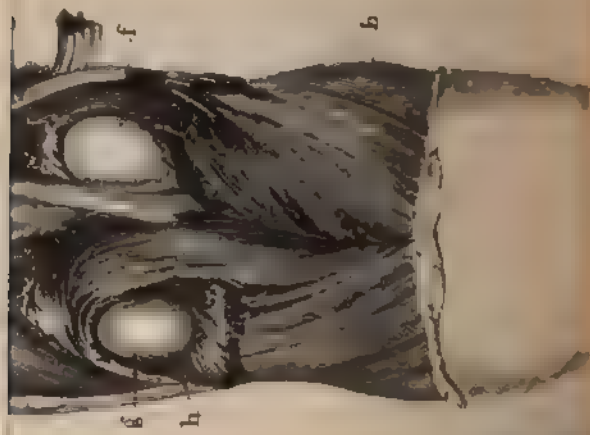
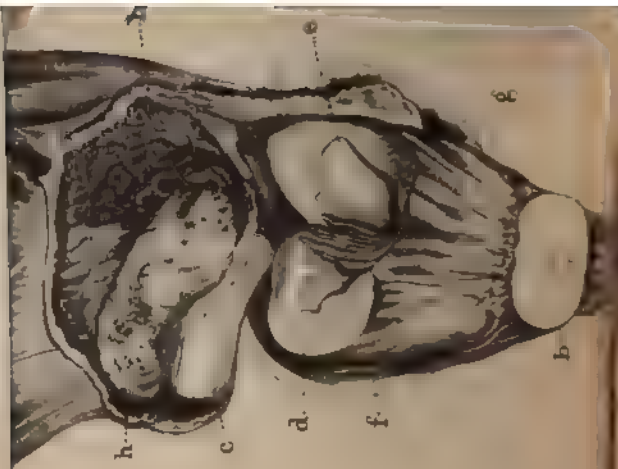


PLATE XIII.

Fig. 1. Shews the thigh-bone in a compound fracture at its condyles into the knee-joint.

Fig. 2. Posterior view of the same knee.

- a*, Muscles of the thigh.
- b*, Gastrocnemius.
- c*, Sciatic nerve.
- d*, Popliteal vein.
- e*, Popliteal artery.
- f*, External condyle, which had torn the capsular ligament and muscles posteriorly.
- g*, Internal condyle, which had also torn the ligament and muscles.
- h*, Torn ligaments.

Fig. 3. Shews an anterior view of a dislocation of the thigh at the knee-joint outwards.

- a*, Muscles of the thigh.
- b*, Patella.
- c*, External condyle of the os femoris, which had passed through the ligaments and skin.
- d*, One semilunar cartilage.
- e*, The other semilunar cartilage.
- f*, Head of the tibia.
- g*, Leg.
- h h*, Capsular ligament.

union exceedingly overlaps, and that it is very feeble; shewing what I have already mentioned, that a fracture thus circumstanced has the ossific deposition only on that side where the inflammation was preserved by the pressure of one bone on the other. This preparation may be seen in the Anatomical Museum, St. Thomas's Hospital.

To prevent this horrid distortion and imperfect union, two circumstances are to be strictly observed: the one is, to elevate the knee very much over the double inclined plane; and, the other, to place the patient in a sitting position, supporting him by pillows during the process of the union. The degree of elevation of the body which is required, will be about forty-five degrees, but it may be readily ascertained by observing the approximation of the fractured extremities of the bones; and this position is requisite for relaxing the psoas and iliacus muscles, and thus preventing the elevation of the upper part of the bone. In no other manner can the great deformity I have described, be prevented. When, by this posture, the extremities of the bones are brought into proper apposition, and all projections of the upper portion are removed, either the splints may be applied which are commonly used in fracture of the thigh-bone; or, what is better, a strong leathern belt, lined with some soft material, should, by means of several straps, be buckled around the limb, and be confined by means of a strap around the pelvis.

DISLOCATIONS OF THE KNEE.

The broad surfaces of bone by which the os femoris rests upon the tibia tends to prevent the ready dislocation of this joint, which would be otherwise very liable to happen from the superficial nature of the articulating cavities on the head of the tibia, and also from the great violence to which the knee is often exposed.

The depressions upon the head of the tibia are increased by the addition of the semilunar cartilages which rest upon the bone; they receive the condyles of the os femoris, and are attached by ligaments to the edge of the tibia. The fore part of the joint is

Structure of
the knee.

Bone.

defended by the patella, which has two unequal articular surfaces to play upon the condyles of the os femoris. The head of the fibula forms no part of the knee-joint, but is attached to the tibia from one half to three-fourths of an inch below its head.

Ligaments.

The junction of the os femoris, tibia, and patella, is produced by means of a capsular ligament, which proceeds from the os femoris to the head of the tibia, and is attached to the edge of the patella, where it divides into two portions, forms wings to that bone, and takes the name of the alar ligament. On its outer side the capsular ligament is covered, and greatly strengthened, by tendinous expansions, which are derived from the vasti muscles, and which proceed to the head of the tibia. Internally the ligament has a secreting synovial surface, which is folded within the cavities at the extremities of the bones, is reflected to the edge of the articular cartilages, and it is believed, forms a covering to those cartilages. Besides the capsular, there are several peculiar ligaments. First: The ligamentum patellæ, which are extended from the lower point of the patella to the tubercle of the tibia. Secondly: The external lateral or femoro-fibular ligament, which passes from the os femoris to the head of the fibula, and which divides into two external lateral ligaments. Thirdly: The internal lateral or femoro-tibial ligament, attached to the os femoris and to the head of the tibia. Fourthly: The oblique or popliteal ligament, which proceeds from the external condyle of the os femoris obliquely, to be inserted into the head of the tibia. Fifthly: The crucial ligaments, which pass from the depression between the condyles of the os femoris behind; the one to a projection between the articular surfaces of the head of the tibia, and the other to a depression behind that projection, so that these ligaments cross each other from before backwards. The patella has a muscular connection with the os femoris by the insertion of the rectus, vasti, and cruralis. By the ligamentum patellæ it is united with the tibia, and laterally it is joined to the capsular and alar ligaments. This ligamentous junction of the three bones is very firm, but it allows of free flexion and extension, with some degree of rotatory motion when the knee

is bent; but although great strength is evident in the construction of this joint, still excessive violence and extreme relaxation will occasionally produce its dislocation.

DISLOCATION OF THE PATELLA.

The patella is liable to be dislocated in three directions: namely outwards, inwards, and upwards. In its lateral dislocation, the bone is most frequently thrown on the external condyle of the os femoris, where it produces a great projection; and this circumstance, with an incapacity of bending the knee, is the strong evidence of the nature of the injury. The most frequent cause of the accident is, that a person in walking or running, falls with his knee turned inwards, and the foot outwards; and thus by the action of the muscles to prevent the fall, the patella is drawn over the external condyle of the os femoris; and when the person attempts to rise he finds himself unable to bend his leg, and the muscles and ligaments of the patella are all forcibly on the stretch. This accident generally occurs in those who have some inclination of the knee inwards, which, under the action of the extensor muscles, gives a direction to the patella outwards.

Three directions.

Symptoms.

Cause.

External.

The internal dislocation is much less frequent, and it happens from falls upon a projecting body, by which the patella is struck upon its outer side, or by the foot being, at the time of the fall, turned inwards. In either of these cases the ligament will be torn, unless there be some previous disease.

Internal.

Mr. Harris, getting into a chaise, caught his foot in the carpet at the bottom of it, by which accident the knee was turned in and the leg outwards; the patella slipped upon the external condyle of the os femoris, but it returned very soon, by the effort of the muscles, into its natural situation. On examination, I found the internal portion of the capsular ligament torn, and a great accumulation of synovia in the joint.

The mode of reduction in either case, consists in pursuing the following plan:—The patient is placed in the recumbent posture and an assistant raises the leg by lifting it at the heel; the advan-

Mode of reduction.

tage of which is, that it relaxes the extensor muscles on the in the greatest possible degree; the surgeon then presses that edge of the patella which is most remote from the joint, one luxation or the other; and this pressure raises the edge of the bone over the condyle of the os femoris, and immediately drawn, by the action of the muscles, into its situation.

Case,

My friend, Mr. George Young, informed me, that he was to a case of dislocation of the patella outwards, in which the reduction was very difficult. The patient was a female, who, fall in walking, had the patella drawn over the external condyle of the os femoris, where it remained. He employed pressure on the edge of the patella, most perseveringly, without being able to succeed, but at last reduced it in the following manner:—placed the patient's ankle upon his shoulder, and thus most completely extended the limb and obtained a fixed point of resistance at the knee; then grasping the patella with the fingers of his hand, he pressed the outer edge of the patella with the ball of his left thumb, and pushed it into its place.

Refrigerant lotion.

When the reduction of this bone has been effected, an evaporating lotion of spirits of wine and water is to be applied; in four or three days the limb may be bandaged, and it is soon restored to its natural uses, although somewhat weaker than before.

I was informed, by Mr. Welling, formerly surgeon at Hasted, that he was called to a case in which the patella was dislocated upon its edge. The nature of the accident was very obvious; the edge of the bone forced up the integuments to a considerable height between the condyles on the fore part of the joint. Welling reduced the dislocation, but with considerable difficulty, by pressing the edges of the bone in opposite directions.

When the bone is dislocated from relaxation, the patella is drawn upon the external condyle of the os femoris by very slight accidents, or sudden action of the muscles. My neighbour, Mr. Hutchinson, a very intelligent surgeon, informs me he has very frequently seen this accident, and that the tendency to it has arisen, in a late

proportion of cases, from the relaxation produced by excessive indulgence in onanism.

The reduction, in these cases, is effected in the manner which has been before described; and after the reduction, to prevent any recurrence of the accident, and to support the weakened ligament, a padded knee-cap, with a strap and buckle over and below the patella, is to be worn.

I once saw the patella drawn over the external condyle of the os femoris from loss of action of the vastus internus, owing to a disease in the thigh-bone.

DISLOCATION OF THE PATELLA UPWARDS.

In this dislocation, the ligament of the patella is torn through the action of the rectus femoris muscle, and the immediate effect of the injury, is to draw the patella upwards upon the fore part of the thigh-bone. The appearances which this accident presents are very decisive of its nature; for in addition to the elevation of the patella, and its easy motion from side to side, a deep depression is felt above the tubercle of the tibia from the absence of the ligament; the patient immediately loses the power of bearing upon that limb, as the knee bends under each attempt, and he would not if he persisted in throwing the weight of his body upon it. A considerable degree of inflammation is the consequence.

Ligament lacerated.

Symptoms.

In the treatment of this injury, local depletion and evaporating fomentations are to be used during four or seven days from its occurrence, and then a roller is to be applied around the foot and upon the leg, to prevent its swelling; the leg is to be kept extended by a splint behind the knee, and a bandage, composed of a leathern strap, is to be buckled around the lower part of the thigh: to this is to be attached another, which is to be carried on each side of the leg, and under the foot, and is to be buckled to the circular strap; thus the bone is gradually drawn down, so as to allow of a union of the ligament. In a month the knee may be slightly bent, and as much passive motion daily given as the patient is able to bear; by these means the ruptured ligament becomes united, and

Treatment.

the patella retains its motion. During the time the bandage worn, the patient is to preserve the sitting posture, in order to relax the rectus muscle and to prevent its action upon the patella. With very great attention the union becomes perfect; for it happened in a case which I saw with Mr. Burrowes, in Bishopgate-street, who paid great attention to the case, that the patient recovered without any diminution of the natural powers of the part; the patella being gradually forced down until the ends of the ligament had approximated and coalesced.

Dislocation
downwards.

With respect to dislocations of the patella *downwards*, at which some surgeons have hinted, I have seen no injury which deserves such a title, if I except a rupture of the tendon of the rectus which I have twice witnessed, and which destroyed the attachment of that muscle to the patella. The appearance of this injury is a soft swelling above the patella, upon which, when the hand is placed, it sunk into the joint; the patella fell loose between the condyles of the os femoris and the head of the tibia, but it retained very much its usual situation, and could not be said to be luxated, as it was not displaced from the joint. The treatment which this accident requires, is that the patient be obliged to preserve the sitting posture during the cure: and that a cushion be applied upon the ligamentum patellæ, which is to be confined by a roller passed around the head of the tibia.

DISLOCATION OF THE TIBIA AT THE KNEE-JOINT.

In four directions.

These dislocations occur in four different directions; but two of them are incomplete, and lateral, while the others are perfect luxations, the tibia being thrown either backwards or forwards.

Internal.

The lateral dislocations are but rare. In the dislocation inward the tibia is thrown from its situation, so that the condyle of the os femoris rests upon external semilunar cartilage, and the tibia projects on the inner side of the joint, so as at once to disclose the nature of the injury. The first case of this kind which I ever witnessed was brought to St. Thomas's Hospital whilst I was apprentice there, and I remember being struck with three circu

stances in it; the first was, the great deformity of the knee from the projection of the tibia; the second, the ease with which the bone was reduced by direct extension; and the third, the little inflammation which followed upon what appeared to be so serious an injury; for the man was discharged from the hospital after a few weeks, having suffered little local or no constitutional irritation.

The tibia is sometimes thrown upon the outer side of the knee-joint, the condyle of the os femoris being placed in the situation of the inner semilunar cartilage, or rather behind it, when the same deformity is produced as in the external dislocation. The reduction of the limb is equally easy with the former, and the patient recovers with little diminution of the powers of the part. It seems to me, that in both these dislocations the tibia is rather twisted upon the os femoris, so that the condyle of the os femoris, with respect to the tibia, is thrown somewhat backwards, as well as outwards or inwards. External.

One of the aldermen of the city of London, riding down Highgate-hill during the night, and not being aware of a rail that was placed across a part of the road, which was undergoing repair, the horse ran against the rail, and turning quickly, threw his rider over it, while his leg was confined between the rail and the horse, so that his body was on one side the rail and his leg on the other: the result of this accident was, that he partially dislocated his tibia outwards, throwing the condyle of the os femoris inwards. Being immediately taken to a public-house, the tibia was easily replaced; and on his removal home, some hours afterwards, means were used to reduce the swelling and inflammation, which became considerable. When he attempted to bear upon the limb he found the capsular ligament very feeble, and he was obliged to have a knee-cap made of very strong leather, to support and connect the bones; by the aid of this bandage he gradually recovered, and was enabled to walk well, and to do duty on horseback as a light-horse volunteer, before twelve months had expired. Case of dislocation outwards.

I was consulted by Mr. Richards respecting Mr. Bovill, a gen-

tleman from Barbadoes, who had dislocated his knee. I made a few notes on the case at the moment, which were as follow.

Case of dislocation inwards.

The gentleman was thrown from a gig; the tibia was dislocated, and the fibula broken a little below its head. The head of the tibia projected much on the inner side of the condyle of the femoris. My friends, Mr. Caddell and Mr. Richards, surgeons at Barbadoes, saw him a quarter of an hour after the accident; the leg was extended from the thigh-bone in a bent position of the limb; the extension was a long time continued, and force was employed by several persons for half an hour before the luxation was reduced. The limb became excessively swollen, and remained so for many weeks, the climate probably being unfavourable to his recovery; but, at length, the inflammation and its consequences were subdued by local depletion. When I saw him, eighteen months had elapsed from the accident, and he could not then bend the joint at right angles with the thigh; there was also an unnatural lateral motion of the joint, from the injury which the ligaments had sustained. The fracture of the fibula had injured the peroneal nerve, as was evident from the numbness of which he complained in the outer part of the leg and foot.

Dislocation forwards.

The tibia is now and then dislocated in a direction forwards. In this accident, when the person is recumbent, the external marks of the injury are these: the tibia is elevated; the thigh-bone is depressed, and is thrown somewhat to the side as well as backwards; the os femoris makes such pressure on the popliteal artery, as to prevent the pulsation of the anterior tibial artery on the foot; the patella and tibia are drawn by the rectus muscle forwards. Such were the appearances in a man of the name of Briggs, brought into Guy's Hospital in the year 1802, not only with this accident, but with a compound fracture of the tibia of the other leg, with dislocation of the head of the fibula. Mr. Lucas was obliged to amputate the compound fracture, and the man is now living at Walworth. The limb in this case was easily reduced by extending the thigh from above the knee, and by drawing the leg from the thigh, and inclining the tibia a little downwards. As

soon as it was reduced, the popliteal artery ceased to be compressed, and the pulsation in the anterior tibial artery was restored.

The head of the tibia is sometimes dislocated backwards, behind the condyles of the os femoris, producing the following appearances; the limb shortened, the condyles of the os femoris projecting, the ligament of the patella depressed, and the leg bent forwards. Dislocation backwards.

PARTIAL LUXATION OF THE THIGH-BONE FROM THE SEMILUNAR CARTILAGES.

Under extreme degrees of relaxation, or in cases in which there has been increased secretion into a joint, the ligaments become so much lengthened, as to allow the cartilages to glide upon the surface of the tibia, and particularly when pressure is made by the thigh-bone on the edge of the cartilage. That excellent practical surgeon, the late Mr. Hey, of Leeds, was the first who early described the symptoms and cause of these accidents, and suggested a mode of treatment which is ingenious, scientific, and generally successful. The injury most frequently occurs when a person in walking strikes his toe, with the foot everted, against any projection, (as the fold of a carpet,) after which he immediately feels pain in the knee, which cannot be completely extended. I have seen this accident also happen from a person lying suddenly turned in his bed, when the clothes not suffering the foot readily to turn with the body, the thigh-bone has slipped from its semilunar cartilage. I have also known it occur from a sudden twist of the knee inwards when the foot was turned out. From relaxation.

The explanation of this accident is as follows: the semilunar cartilages, which receive the condyles of the os femoris, are united to the tibia by ligaments, and when these ligaments become extremely relaxed and elongated, the cartilages are easily pushed from their situations by the condyles of the os femoris, which are then brought into contact with the head of the tibia; and when Mr. Hey's ideas.

Explanation of the accident.

Mode of reduction.

the limb is attempted to be extended, the edges of the semilunar cartilages prevent it. How then is the bone to be again brought upon the cartilages? Why, as Mr. Hey has advised, by bending the limb back as far as is possible, which enables the cartilage to slip into its natural situation; the pressure of the thigh-bone is removed in the bent position, and the leg being brought forwards, it can be completely extended, because the condyles of the os femoris are again received on the semilunar cartilages. This plan is not, however, invariably successful, as the following case will shew. A lieutenant in the army suffered this accident repeatedly, and the limb was as often reduced by the above means; but at length, turning in bed, from the pressure of the bed clothes on his foot, the accident recurred. He came to town; but bending the limb had now no effect in enabling him to extend the joint, I therefore advised him to visit Mr. Hey, at Leeds; but I learned that in this case the dislocation was never reduced.

Different mode of reduction.

I made the following notes of the case of a gentleman who came to my house. Mr. Henry Doble, aged thirty-seven, has often dislocated his knee, turning the foot inwards and the thigh-bone outwards, by accidentally slipping on uneven ground, or by sudden exertions of the limb; considerable pain was immediately produced, accompanied with a great deal of swelling. His mode of reducing it is as follows: he sits upon the ground, and then bending the thigh inwards, and pulling the foot outwards, the subluxation of the os femoris being external, the natural position of the limb becomes restored. A knee-cap laced tightly around the knee, is the usual preventive of the return of this accident; but it is not sufficient in Mr. Doble without the addition of straps, and more especially of a very strong one of leather, just below the patella.

Particular bandage required.

A young lady was brought to my house who was frequently the subject of this accident, but in her the cartilages had been several times easily replaced, and the return of the accident prevented by a bandage composed of a piece of linen with four rollers at

tached to it, which were tightly bound above and below the patella; this, she said, answered its intended purpose better than any other contrivance.

In some of these cases great alteration takes place in the form and size of the knees, from a chronic rheumatism occasionally attending them.

In the dissection of these cases, the ligament is found extremely thickened; little pendulous ligamentous and cartilaginous bodies are seen suspended from it; a thick edge of cartilage projects from the articular cartilage, and a part of the latter is absorbed. When the bone is macerated, a great addition of ossific matter is found to have been made to the edges of the condyles of the os femoris.

DISLOCATION OF THE KNEE-JOINT.

Cases of dislocation of the knee-joint are so rare, that every instance of this accident is worthy of recital; and I feel greatly indebted to my friend, Mr. Toogood, surgeon at Bridgewater, for the following detail of a case of this description which occurred under his care.

December 5th, 1806.

Francis Newton, a strong athletic man, thirty years old, fell Case.
from the fore part of a waggon, and his foot being entangled in the frame-work of the shaft, he was dragged a very great distance before he was released. I saw him two hours after the accident. The left knee was very much swollen; the tibia, fibula, and patella were driven up in front of the thigh; and the os femoris occupied the upper part of the calf of the leg, the internal condyle being nearly through the skin. It was a complete dislocation, and the appearance of the limb so dreadful, that I despaired of being able to reduce it; but, to my surprise, it was more easily effected than I imagined. By placing two men to the thigh whilst I extended the leg, the man became directly relieved. The whole limb was placed in splints, and the strictest antiphlogistic treatment observed, with the most perfect quiet. The symptoms were very

mild; and, by carefully watching him, he suffered very little inflammation or pain. At the expiration of a month I allowed him to get up, and on the 29th of January, he came into this town, a distance of four miles, in a cart, and walked from an inn to my house, with his leg but little swollen, and having some motion of the joint. He eventually recovered a very good use of his limb, and walks with so little inconvenience, that he has followed his business as a waggoner ever since; and this day, November 30th, 1822, I have seen him walking by the side of his team with very little lameness.

COMPOUND DISLOCATION OF THE KNEE-JOINT.

Having seen only one instance of this dislocation, I conclude it to be a rare occurrence; and there are scarcely any injuries incident to the body, which more imperiously demand immediate amputation than these.

Case.

On Monday, August 26th, 1819, at eleven p. m., I was sent for by Mr. Oliver, of Brentford, to visit Mr. Pritt, who had fallen from the box of a mail-coach, and most severely injured his knee. I met, at the house to which he was carried, Mr. Oliver, and Mr. Hunter, of Richmond, surgeons, and immediately proceeded to examine the knee. A large opening was found in the integuments, through which the external condyle of the os femoris projected, so as to be on a level with the edges of the skin. The os femoris was thrown behind the tibia on the outer side of the head of the latter, and the external condyle of the thigh-bone was dislocated backwards and outwards; the thigh-bone was twisted outwards, and the internal condyle advanced upon the head of the tibia. I made attempts to reduce the condyle, but it could only be effected with extreme difficulty; and the bone, directly when the extension was removed, slipped into its former situation. The joint being freely opened by the accident, the bone dislocated, and when reduced easily slipping from its place, and the patient having an extremely irritable constitution, I determined at once to propose the amputation of the limb, which being acceded to, was immediately

performed. The symptoms of constitutional irritation which followed the operation became extremely severe, and being delirious on the 31st, Mr. Oliver applied leeches to his temples, a blister under the occiput, and gave the saline medicine with the camphor, and the pulv. ipec. comp. On the following day I was sent for, but being absent from London, my valued friend, Mr. Cline, visited him, and ordered him tinc. opii. gtt. v.—Pulv. castor. gr. x.—Mist. camphor. ʒiss. m.—Ft. haustus 4ta quaque hora sumendus. Soon after the second draught was administered he fell asleep, and after several hours' repose awoke perfectly sensible. He gradually recovered, and left Brentford on the 25th of October, with a small wound still remaining on the stump.

I brought home the limb, and carefully dissected it. Under the skin there was great extravasation of blood in the cellular membrane surrounding the knee; the vastus internus muscle had a large aperture torn in it just above its insertion into the patella; the tibia projected forwards; and the patella was drawn to the outer side of the knee, being no longer in a line with the tubercle of the tibia. Looking at the joint posteriorly, both heads of the gastrocnemius externus muscle were lacerated; the capsular ligament was so completely torn, posteriorly, that both the condyles of the os femoris were seen projecting through the laceration in the gastrocnemius; neither the sciatic nerve, the popliteal artery and vein, the lateral, nor the crucial ligaments, were ruptured. Dislocation.

It is probable that all compound dislocations of the knee-joint will require a similar practice, unless the wound be so extremely small as to admit readily of its immediate closure and adhesion.

DISLOCATION OF THE KNEE FROM ULCERATION.

In the progress of chronic diseases of the joints, inflammation beginning in the synovial membrane, and proceeding to ulcerate the articular cartilages and bone, at length affect the capsular ligament, and sometimes even the peculiar ligaments of the joints; the bones thus becoming unconnected, the muscles irritated by Ligament ulcerated.

Excessive distortion.

participating in the inflammation, draw the limb into distorted positions, and thus one bone becomes gradually displaced from the other. This state is most frequently seen in the hip-joint, from the oblique bearing of the thigh-bone on the pelvis. In the knee it is also not unusual that the thigh-bone shall be placed out of its natural line with the tibia, projecting either on the one side or the other.

Now and then most remarkable distortions are produced by the irritative and spasmodic action of the muscles succeeding the ulcerative process of the ligaments. Mr. Cline removed the limb in St. Thomas's Hospital. It had been the consequence of what is vulgarly called the white swelling of the knee-joint; the leg was placed forwards at right angles with the thigh, so that when walking on his crutches he had the most grotesque appearance, as the bottom of his foot first met the eye when he was advancing. Upon inspection of the patella it was found ankylosed to the os femoris, and the tibia was also joined by ossific union to the fore part of the condyles of the thigh-bone.

How prevented.

This state of parts may be prevented by opposing the action of the muscles when their irritability first begins to produce distortion; by the application of splints; and by the exhibition of the pulvis ipecacuanhæ compositus, to diminish the irritability of the system. Thus I have seen, in cases of ulceration of the hip-joint, the irritative action of the flexor muscles diminished, and future distortion prevented, by drawing down the limb and keeping it in the extended position; but as this extension is most painful to the patient, however desirable it may be, it should be accomplished very gradually.

FRACTURES OF THE KNEE-JOINT.

I shall now, pursuing my former plan, describe the fractures to which the bones entering into the composition of this part are liable; and first, the

FRACTURES OF THE PATELLA.

This bone is generally broken transversely, sometimes, though rarely, longitudinally; it is liable also to simple and compound fracture; but, fortunately, the latter is but of rare occurrence.

Transverse or longitudinal.

When the patella is transversely broken, the upper part of the bone is drawn from the lower, its superior portion being elevated by the action of the rectus, vasti, and cruralis muscles, which are inserted into its upper part; whilst the lower portion is still retained in its natural situation by the ligament which passes from it to the tubercle of the tibia.

Symptoms.

The degree of separation thus produced, depends on the extent of laceration of the ligament; for when the ligament is but little torn, the separation will be half an inch, but under great extent of injury, the bone is drawn five inches upwards, the capsular ligament and tendinous aponeurosis covering it being then greatly lacerated; and this, with one exception, is the greatest extent of separation which I have seen. The accident may be at once known by the depression between the two portions of bone; by the fingers passing readily down to the condyles of the os femoris into the joint as far as the integuments will permit; and by the elevated portion of bone moving readily on the lower and fore part of the thigh. The power of extending the limb is lost immediately after the accident, and likewise that of supporting the weight of the body on that leg, if the person be standing; for the knee bends forwards from the loss of action in the extensor muscles. The pain in this accident is not very severe; and a simple fracture is not dangerous, for the constitution feels it but little. In a few hours after the accident, a considerable degree of extravasation of blood takes place upon the fore part of the joint, so that the appearance is livid from ecchymosis; but this is removed by absorption in a few days. Considerable inflammation and fever succeed, and there is a great degree of swelling in the fore part of the joint, both from the free secretion of synovia, and the effusion arising from inflammation. No crepitus

Degree of separation.

is felt in this fracture, for the bones cannot be brought sufficiently near each other to give this general discriminating mark of other fractures.

The separation of the bones is much increased by bending the knee, as it removes the lower from the upper portion of bone, pulling down the tibia, ligamentum patellæ, and the lower part of the bone from the upper.

Causes.

Blows or actions
of the muscles.

This accident arises from two causes : first, from blows upon the bone produced by falls upon the knee, or received upon the patella in the erect position of the body ; and secondly, from the action of the extensor muscles upon the bone.

Case.

A gentleman walking in the country, and not used to jumping, leaped a ditch of considerable breadth ; and when he reached the opposite bank he was in danger of falling, and ran forward several steps, and with difficulty recovered himself. In this attempt to save himself from a fall, he felt the patella snap ; and I was sent for to him, and found his patella broken, and the portions of bone considerably separated.

Case.

A lady descending some stairs, placed her heel near the edge of one of the stairs, and was in danger of falling forwards, when throwing her body somewhat backwards, to prevent the fall and to straighten the knee, the patella became broken.

**Explanation
of it.**

That a bone should thus break by the action of muscles, appears at first sight incomprehensible ; but the solution of this circumstance is easily given. When the knee is bent, the patella is drawn down on the end of the condyles of the os femoris, so as to bring the upper edge of the bone forwards ; and at that moment it is that the patella is broken, by the rectus muscle not acting in a line with the bone, but at right angles with it, or nearly so, and upon its upper edge more particularly.

Mode of union.

With respect to the mode of union of this bone, whether the separation be great or inconsiderable, it is generally effected by an intervening ligamentous substance. The bone itself undergoes but little alteration ; the lower portion, joined by ligament to the patella, has its broken cancellated structure still apparent, al-

though a little smoothed. The upper portion of bone has its broken cancelli covered by a slight ossific deposit, so that there is more ossific action in the upper than in the lower portion of the bone, and certainly much less than in bones which do not form a part of the joints. The internal articular surface of the bone preserves its natural smoothness. Blood is immediately deposited in the place of the injured ligament; but this in a few days is absorbed. Inflammation arises and pours out adhesive matter, which extends from one edge of the lacerated ligament to the other, and even between the bones, to each of which it is firmly united. Vessels shoot from the edges of the ligament and render the new substance organized, and produce a ligamentous structure similar to that from which the vessels shoot; this substance is not, however, always perfect, for I have seen apertures in it; but this will greatly depend upon the extent of the laceration of the ligament, and the too early use of the limb. In the dog and in the rabbit, or almost any other quadruped, it is possible by experiment to trace the mode of union of this bone.

Experiment I.

I drew the integuments much aside in a rabbit, and dividing them, placed a knife upon the patella and struck it lightly with a mallet; the bone was broken and directly drawn up by the action of the muscles. I let the integuments go, and the wound was not opposite the fracture. In forty-eight hours I killed the animal and examined the part. The bones were separated three quarters of an inch, and the intervening part filled with coagulated blood.

Experiment II.

I repeated the former experiment, and killed the animal on the eighth day, and found most of the blood absorbed, and adhesive matter occupying the space between the bones.

Experiment III.

The former experiment repeated; the animal examined on the

fifteenth day. The adhesive matter had acquired a smooth and somewhat ligamentous character.

Experiment IV.

The same division of the bone being made, it was examined on the twenty-second day, when the new ligament was complete.

Experiment V.

The same repeated in five weeks. The part was injected, and vessels were found proceeding from the edge of the ligament into the adhesive matter now become ligamentous. So that at the end of five weeks the vascularity is complete, and some vessels proceed into the new ligament from the bone, but chiefly from the lacerated ligament. Upon the dog, these processes may be equally well observed; but they are not quite so rapidly produced in a large dog as in the rabbit.

The parts were dissected and preserved after these experiments, both in the dog and rabbit, and they are deposited in the collection of St. Thomas's Hospital, where they may be always seen.

Experiment VI.

In the rabbit, having divided the bone, I sewed the two portions by conveying a needle and thread through the tendinous covering of the bone; but the ligatures separated, and the bones still united by ligament.

Experiment VII.

I divided the bone, and cut the rectus muscle across above it, yet the patella united by ligament.

I could not, either in the dog or the rabbit, succeed in producing a bony union in the transverse fracture.

Yet I once saw a patient of my kind friend, M. Chopart, at Paris,—a case which appeared to me to be united by bone; and Mr. Fielding, of Hull, has lately published a similar case.

A ligamentous union of the transverse fracture of the patella is that which generally occurs; and if there be an exception, it is

very rare. But still the principle which is to guide the surgeon's conduct is, to make that ligament as short as possible. If the ligament be of great length, there is a proportionate weakness; for as soon as the accident has happened, the rectus muscle retracts and draws up the superior portion of the patella; and in proportion to the retraction suffered to remain, is the degree of shortening of the muscle, and, consequently, the diminution of its power. Those, therefore, who have had the bones unite when widely separated; if they walk quickly, do it with a halt; and are very liable to fall, and to break the other patella. Let then the muscle be brought as nearly as it can be into its natural length; and although complete apposition of the bone is very rarely effected, yet the ligamentous union is rendered as short as circumstances will permit, and the patient will recover the power of the limb.

Ligamentous
union as short
as possible.

The idea which was formerly entertained of the danger of squeezing the callus into a projection in the inner side of the bone, so as to destroy the smoothness of its internal surface, is not at all tenable

When called to this accident, the surgeon places the patient in bed upon a mattress, extends the limb upon a well padded splint placed behind the thigh and leg, to which it is tied, and which splint should be hollowed. The patient's body should be raised as much as he can bear to the sitting posture, to relax the rectus muscle. An evaporating lotion is to be then applied upon the knee consisting of liq. plumbi s. acetat. dilut. $\frac{3}{4}$ v. with spir. vini. $\frac{3}{4}$ i.; and no bandage should be at first employed. The body should be slightly raised in bed to relax the rectus muscle, and the heel should be raised to bring up the lower portion of the patella. If, on the succeeding day or two, there be much tension or ecchymosis, leeches should be applied, and the lotion be continued; when, after a few days, the tension has subsided, then, and not till then, should bandages be employed. I have seen the greatest suffering and swelling produced by the early application of bandages in these cases, even so as to threaten slough-

Treatment.

ing of the skin, when there had been much contusion. The means which are most frequently employed in the treatment of this case are as follow:—A roller is applied from the foot to the knee, to prevent the swelling of the leg: and the upper portion of the bone is pressed downwards, as far as it can be without violence, towards the lower, so as to lessen the retraction of the muscles, and produce the approximation of the portions of bone. The rollers are applied above and below the joint, confining a piece of broad tape next the skin on each side, which crosses the rollers at right angles; these portions of tape are bent down and laid over the rollers so as to bring them near to each other, and thus keep down the upper portion of bone. Sometimes, instead of the tape on each side, a broad piece of linen is bent over the rollers on the fore part of the joint, and is there confined so as to approximate the pieces of bone, and to bind down the upper portion of the patella that its lower broken edge may not run forwards.

But the mode I prefer is as follows:—A leathern strap should be buckled around the thigh, above the broken and elevated portion of bone; and from this circular piece of leather, another strap is passed under the middle of the foot, the leg being extended, and the foot raised as much as possible. This strap is brought upon each side of the tibia and patella, and buckled to that which is fixed around the lower part of the thigh. The strap may be confined to the foot by a tape tied to it, and to the leg at any part in the same manner; and this is the most convenient bandage for the fractured patella, and for the patella dislocated upwards by the laceration of its ligament; a roller is to be applied upon the leg.

In this position, and thus confined, the limb is to be kept for five weeks in the adult, and for six weeks at a more advanced age.

Then a slight passive motion is to be begun, and this must be done gently and with so much circumspection, that the ligament, if not firmly united, shall not give way, nor the bones recede.

union be found sufficiently firm to bear it, the passive motion to be employed from day to day, until the flexion of the limb be complete.

If passive motion be not used, it appears that the action of the extensor muscles would never return; for those who are kept bed with the joint at rest, do not in many months acquire any power of bending or extending the limb: but when passive motion is to be used, the patient is placed on a high seat and directed to swing the leg, by which motion is given to the rectus; and if the mind be then directed to the contraction of that muscle, its powers will be gradually renewed. When the rectus muscle has been shortened, and the upper portion of bone is drawn from the lower, all the disposition to action in that muscle ceases; and it does not seem disposed to recover its voluntary action until it becomes again elongated, which is effected after the union of the fragment, by bending the knee: and from this point of elongation the muscle begins to contract.

State of the muscle.

A young woman was brought into my house in her father's arms; and he said, "I am obliged to carry her, for she has lost the use of her legs, having broken both her knee-pans eight months ago, and she has never been able to use her limbs since." Passive motion was directed, and she was ordered to try to extend her legs after they had been bent by the surgeon. At first she could effect but little; however, by repeated trials, she gradually recovered the use of her limbs. Mr. John Hunter, who raised surgery into a science, and who seems to have been the first who attended to the principles on which the practice of surgery ought to be regulated, always dwelt most ably upon this subject in his lectures. Patients, from the pain which passive motion produces, and the slow return of action in the muscles, are indisposed to suffer the one, or to make trial of the other; but, without them, there can be no recovery.

The degree of approximation of the bone is, as I have stated, a matter of great consequence. The bone is rarely brought into

Degree of approximation.

contact, so as to be united in the transverse fracture by ossific union; but the less the distance between the bones, the greater is the power which the muscle re-acquires; for, in proportion as the muscle is shortened, it is weakened: and in ascending, there is difficulty in raising the limb; in descending, in keeping it extended; and the uniting ligament is liable to be torn, and the other patella to be broken by falls; therefore, the surgeon should bring the bones as near together as he can, to render the ligamentous union as short as possible, and consequently to leave the muscle with as much of its original power as the nature of the accident will permit.

PERPENDICULAR FRACTURE OF THE PATELLA.

There is in the collection at St. Thomas's Hospital a patella, one fourth of which has been broken off; the edge is smooth, and no attempt at ossific union appears to have been made.

Ligamentous
union.

A gentleman consulted me who had about one third of the patella separated from the other part of the bone; it had united by ligament, for there was free motion between the fractured piece of bone and that from which it had been removed. He recovered quickly from this injury, and it affected his power of walking very little.

During the winter of 1822, a body was dissected at St. Thomas's Hospital, in which both the patellæ had been broken longitudinally; and although they were in contact, they were both united by ligament.

These circumstances surprised me, because I saw no reason why the patella should not be united by bone when broken perpendicularly, as I thought the muscles would have a tendency to bring the parts together. I made it therefore a subject of experiment.

Experiment I.

July 31st, 1818, I broke the patella of a dog by placing a knife

upon it in the longitudinal direction, having first drawn the integuments aside; and on the 12th of September following, I examined the part, when I found the two portions of bone considerably separated from each other, and united by ligament. The cause was as follows:—when I had divided the bone, the knee became bent, the condyles of the os femoris pressed against the inner side of the patella, and thrust the parts asunder, and only a ligamentous union took place.

Union by ligament in experiments.

Experiment II.

August 2d, 1818, I broke in the same manner the patella of a rabbit and examined the parts on September 3d, when I found the two portions of bone widely separated, and united only by ligamentous matter. I now began to think it impossible for the patella to unite by bone, but determined to make another experiment to determine this point.

Experiment III.

I divided the patella longitudinally in a dog, but took care that the division should not extend into the tendon above or to the ligament below it, so that there should be no separation of the two portions. I examined it three weeks after, and found it united; no separation existing between the two portions*.

Union by bone.

Experiment IV.

October, 1819. I divided the patella by a crucial fracture into four portions; the two upper portions neither united with each other, nor with the bones below; but the two lower portions became united by bone.

It appears then, that under longitudinal and transverse fracture, a ligamentous union is generally produced, and that it arises

* The bone was, under maceration, found united in part by bone, and in part by cartilage, not completely ossified. It is preserved, and may be seen at any time by those who are curious to examine it.

from the separation produced in the bone; but if that cannot separate, and its parts remain in contact, ossific union may be produced.

Case. In the summer of 1819, Mr. Marryat was thrown from his gig as he was passing along the Strand; by the fall he fractured his patella transversely and the lower portion of the bone was also broken perpendicularly, so that it was divided into three pieces. The transverse fracture united, as usual, by ligament; but the perpendicular by bone.

Mr. Parrott of Tooting, who also attended the case, writes in these words:

“Dear Sir,—I have great pleasure in replying to your letter. The longitudinal fracture of the patella of Mr. M. has become very firmly consolidated; but there is a line or ridge to be traced upon the surface of the bone, which marks distinctly the place where it had been separated.”

Treatment. In the longitudinal or perpendicular fracture of the patella, the best treatment consists in extending the leg, and in using local depletion and evaporating lotions: in a few days a roller should be applied around the limb, and then a laced knee-cap, with a strap to buckle around the knee above and below the patella, and a pad on each side to bring its parts as nearly as possible into contact.

COMPOUND FRACTURE OF THE PATELLA.

From violence
or ulceration.

These fractures occur from injury, or from an ulcerative process under peculiar circumstances.

If the laceration be extensive, or the contusion very considerable in these cases, amputation will be required; but if the wound be small, and the patient be not irritable, and no sloughing of the integuments or ligament be likely to occur from the nature of the accident, it will be best to try to save the limb. The principal object is, to produce adhesion immediately; and every means in our power must be used for that purpose. I know well that

sutures are generally objectionable, and I never employ them if I can possibly succeed without them; but in moveable parts, in those which are unsupported, and in those through which a secretion is liable to force its way, they are not only justifiable, but highly necessary. Fomentation and poultices must not be employed in these cases, as they prevent the adhesive process.

A compound fracture of the patella will be sometimes produced by an ulcer, as in the following case.

A woman was admitted into Guy's Hospital, in 1816, with a simple and transverse fracture of the patella, which had long been united by a ligament of about three inches in extent. Ulcers were formed upon different parts of the body: and, unfortunately, one of these upon the integuments over the ligamental union of the patella. It became sloughy, and extended through the new ligament to the joint, which it had laid open: violent constitutional irritation succeeded; a copious suppuration was produced; and no opportunity was given of amputating the limb, for the inflamed and swollen state of the thigh forbade it. This woman died.

Case.

Ulceration.

OBLIQUE FRACTURES OF THE CONDYLES OF THE OS FEMORIS INTO THE JOINT.

These cases are of rare occurrence; but when they happen it is difficult to prevent deformity, and to restore to the patient a sound and useful limb. They are known by the great swelling of the joint which ensues, by the crepitus which is felt in moving the joint, and by the deformity consequent upon them. The fracture is sometimes of the inner, and sometimes of the outer condyle, and the bone is split down into the joint.

Of either condyle.

Whether the external or internal condyle be broken, the same treatment is required. The limb is to be placed upon a pillow in the straight position, and evaporating lotions and leeches are to be used to subdue the swelling and inflammation. When this object has been effected, a roller is to be applied around the knee, and a piece of stiff pasteboard, about sixteen inches long and sufficiently wide to extend entirely under the joint, and to pass on each side of it, so

Treatment.

as to reach to the edge of the patella, is to be dipped in warm water, applied under the knee, and confined by a roller. When this is dry, it will have exactly adapted itself to the form of the joint, and this form it will afterwards retain, so as best to confine the bones. Splints of wood or tin may be used on each side of the joint, but they are apt to cause uneasy pressure. In five weeks passive motion of the limb may be gently begun, to prevent ankylosis. I prefer the straight position in these cases, because the tibia presses the extremity of the broken condyle into a line with that which is not injured.

Examples of compound fractures of the condyles are very unfrequent. To aged persons these accidents sometimes prove fatal; and indeed I have known a simple fracture of the condyles terminate fatally.

OBLIQUE FRACTURES OF THE OS FEMORIS JUST ABOVE ITS CONDYLES.

Oblique fractures of the condyles.

This is a most formidable injury from its consequence on the future form and use of the limb; for it is liable to terminate most unfortunately, by producing deformity, and by preventing the flexion of the knee-joint.

It is only of late years that I have had an opportunity of investigating this case by dissection; and, consequently, of obtaining substantial knowledge of the exact nature of the injury. The appearances produced by it are, that the lower and broken extremity of the shaft of the bone projects, and forms a sharp point just above the patella, which pierces the rectus muscle, threatens to tear the skin, and sometimes does tear it: whilst the patella, tibia, and condyles of the os femoris sink into the ham, and are drawn upwards behind the broken extremity of the shaft of the os femoris.

The accident happens when the person falls from a considerable height upon his feet, or is thrown upon the condyles of the os femoris with the knee bent. In all the cases the fracture was very

oblique through the shaft of the bone; and hence the pointed appearance of the extremity of the fracture, and the difficulty of keeping the bones in apposition.

A body was brought into the dissecting-room at St. Thomas's Case Hospital, which fell to the lot of Mr. Patey, surgeon, of Dorset-street, Portman-square, to dissect; and he kindly permitted me to make a drawing of the limb. It appeared, upon view of the thigh, that the limb had been broken just above the knee-joint, and that the shaft of the bone projected as far as the skin, just above the patella; the union was firm, but the magnitude of the bone was exceedingly increased. When the integuments were removed, the end of the superior portion of the shaft of the bone was found to have pierced the rectus muscle, through which it still continued to project; and behind this projecting portion of bone the rectus muscle was situated, which passed to the patella. This portion of the rectus muscle attached to the patella, was stopped in its action by the projection of the fracture, so that its movement upwards was exceedingly limited. The condyles of the os femoris, and the lower portion of the bone, had been drawn by the action of the muscles behind the end of the fracture of the upper portion, and had united by a very firm callus to the body of the bone.

This union had necessarily produced a great diminution in the power of extending the limb; for the rectus muscle was really hooked down by the fractured extremity of the bone; but even if the bone had not pierced the muscle, still the elevation of the patella would have been prevented, by that bone being drawn against the fractured end of the thigh-bone in the contraction of the muscle. It appears, then, that in the treatment of this case a most firm and continued extension must be supported to prevent the retraction which would otherwise ensue; the cases which I have seen justify me in saying that this defective union is with great difficulty prevented; as the ordinary extent of flexion in the joint is not to be expected.

FRACTURE OF THE HEAD OF THE TIBIA.

Oblique fractures of the tibia into the joint.

The head of the tibia is sometimes obliquely broken; and if it be fractured into the knee-joint, the treatment which it requires is similar to that which is necessary in the oblique fracture of the condyle of the os femoris; that is, first, to maintain the straight position of the limb, because the femur preserves the proper adaptation of the fractured tibia by serving as a splint to its upper portion, and keeping the articular surfaces in apposition. Secondly, a roller to press one part of the broken surface against the other. Thirdly, a splint of pasteboard to assist in the preservation of that pressure. And fourthly, early passive motion to prevent ankylosis.

Fractures just below the joint.

But if the fracture of the tibia be oblique, yet not into the joint, then it is best to place the limb upon the double inclined plane: for the cause of deformity being the elevation of the lower portion of the tibia, which is drawn up on the side of the knee-joint as the fracture is in the inner or outer side of the tibia, the weight of the leg keeps the limb constantly extended as it hangs over the angle of the inclined plane; and thus the bone is brought into as accurate apposition as the nature of the fracture permits.

DISLOCATION OF THE HEAD OF THE FIBULA.

Union with the tibia.

The fibula joins the tibia three quarters of an inch below the articulation of the knee. Its head is inclosed in a capsular ligament, which unites it to the tibia, to which it is also joined through the greater part of its length by the interosseous ligament.

Produced by violence or relaxation.

This bone is liable to dislocation, both from violence and from relaxation. I have only seen one case of it from violence; and in that instance it was connected with the compound fracture of the tibia.

—— Briggs, of whose dislocation of the tibia I have given an account, had, at the upper part of the other leg, a compound fracture of the tibia, and dislocation of the head of the fibula. An

PLATE XIV.

Fig. 1

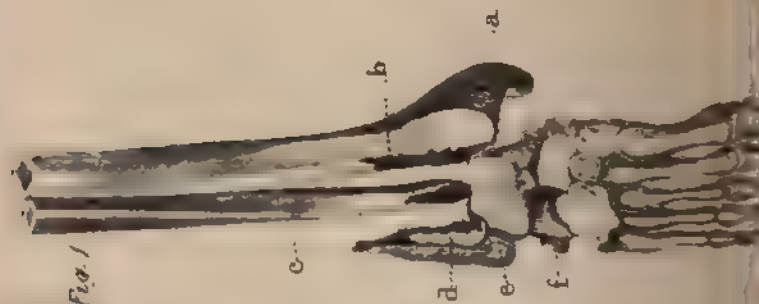


Fig. 2

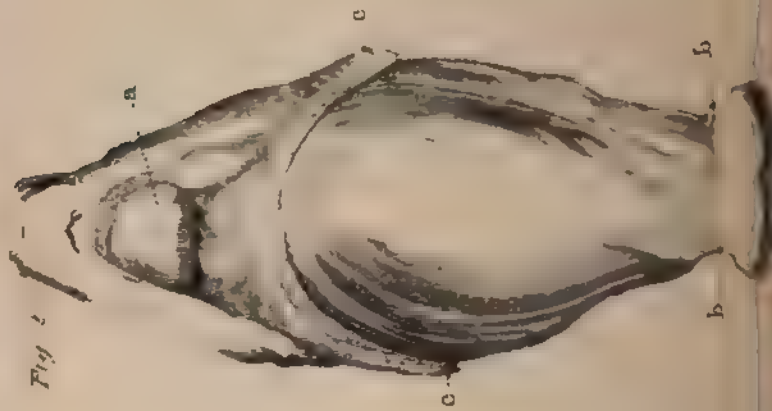


Fig. 3



PLATE XIV.

Fig. 1. Shews the dislocation of the tibia inwards at the ankle-joint.

a, Malleolus internus of the tibia thrown on the inner side of the astragalus.

b, A portion of the tibia split off.

c, Fibula broken.

d, Broken portion of the tibia adhering by ligament to the fibula.

e, Malleolus externus of the fibula, with the broken portion of the tibia adhering to it.

f, Astragalus thrown outwards.

Fig. 2. Fracture of the patella, with ligamentous union and great separation of the bone.

The extent of separation depends upon the degree of laceration of the capsular ligament, and of the tendons of the vasti externi muscles which are spread over it.

a, Upper portion of the patella drawn up by the action of the rectus and vasti.

b, The lower portion of bone.

c to *a*, Original ligament.

c to *b*, New ligament, which from its length excessively diminished the power of the extensor muscles.

Fig. 3. Shews a fracture of the tibia and fibula at the ankle-joint, sent to me by my friend, Mr. Hammick, Surgeon of the Plymouth Naval Hospital.

a, Tibia fractured.

b, Fracture of the fibula.

c, Astragalus.

e, Shell of the bone surrounding a fragment of bone, and so completely enclosing it that it could not be removed, and amputation became necessary.

attempt was made to save the limb, but the constitutional irritation ran so high, that amputation was obliged to be performed; which was done by my colleague, Mr. Lucas, and the man was restored to health.

Dislocations of the head of the fibula from relaxation, are more frequent than those which occur from violence; the head of the bone, in these cases, is thrown backwards, and is easily brought into its natural connection with the tibia, but it directly again slips from its position. This state produces a considerable degree of weakness, and fatigue in walking; and the person suffers much from exercise. As in these cases there is a superabundant secretion of synovia, and a distension of ligament, repeated blistering is required to promote absorption; and afterwards a strap is to be buckled around the upper part of the leg, to bind the bone firmly in its natural situation: a cushion may be added behind the head of the bone to give it support, and at least to prevent the increase of the malady.

DISLOCATIONS OF THE ANCLE-JOINT.

The bones which enter into the composition of the ancle-joint are the tibia, fibula, and astragalus. The tibia forms an articulating surface at its lower part, which rests upon the astragalus; there is a projection on the inner side of the lower portion of this bone, which forms the malleolus internus, and this part is articulated with the side of the astragalus. The fibula projects beyond the tibia at the outer ancle, and forms there the malleolus externus, which has also an articulating surface for the astragalus. The astragalus, which is the superior tarsal bone, rises between the malleoli and the lower part of the tibia, and moves upon it principally in flexion and extension of the foot.

Structure of the joint.

Bone.

Thus nature has strongly protected this part of the body, by the deep socket formed by the two bones of the leg, and by the ball of the astragalus which is received between them.

A capsular ligament, secreting synovia on its internal surface, joins the tibia and fibula to the astragalus. A strong ligament

Capsular ligament.

unites the tibia to the fibula, but without any intervening articular cavity, as the ligament proceeds directly from one surface of bone and is received into the other.

Peculiar ligaments.

The peculiar ligaments joining the tibia and fibula to the tarsus, consist of a deltoid ligament, which proceeds from the tibia to the astragalus, os calcis, and os naviculare. The fibula is united at its lower end by three excessively strong ligaments; one anteriorly from the malleolus externus to the astragalus, one inferiorly to the os calcis, and a third to the astragalus posteriorly: and it is the strong union of this bone which leads to its being more frequently fractured than dislocated. And even when the tibia is luxated, the fibula is fractured in two of the species of dislocation of the ankle, and generally in all; but when the tibia is thrown outwards, I have known the fibula escape a fracture.

Directions of dislocations.

I have seen the tibia dislocated at the ankle in three different directions: inwards, forwards, and outwards; and a fourth species of dislocation is said sometimes to occur, viz., backwards: the foot has also been known to be thrown upwards between the tibia and fibula, by the giving way of the ligament which unites these bones; but this accident is only an aggravated state of the internal dislocation.

SIMPLE DISLOCATION OF THE TIBIA INWARDS.

Dislocation inwards.

This is the most frequent of the dislocations of the ankle. The tibia in this accident has its internal malleolus thrown inwards, and so forcibly projecting against the integuments as to threaten their bursting. The foot is thrown outwards, and its inner edge rests upon the ground. It rotates easily on its axis. There is considerable depression above the outer ankle, much pain, some crepitus, often at three inches from the lower joints of the fibula upwards, facility of lateral motion of the foot, and considerable tumefaction.

Symptoms.

Dissection.

Upon dissection, the internal appearances are as follow. The end of the tibia rests upon the inner side of the astragalus, instead of resting on its upper articular surface; and if the accident

has been caused from jumping from a considerable height, the lower end of the tibia, where it is joined to the fibula by ligament, is split off, and remains connected with the fibula, which is also broken from two to three inches above the joint; and the broken end of the fibula is carried down upon the astragalus, occupying the natural situation of the tibia. The malleolus externus of the fibula remains in its natural situation, with two inches of the fibula and the split portion of the tibia; the capsular ligament attached to the fibula at the malleolus externus, and the three strong fibular tarsal ligaments, remain uninjured.

This accident generally happens in jumping from a considerable height, or in running violently with the toe turned outwards when the foot being suddenly checked in its motion while the body is carried forwards upon it, the ligaments on the inner side of the ankle give way. It may also be caused by a fall on that side when the foot is fixed.

To distinguish a fracture of the fibula, the hand must grasp the leg just above the ankle, and the foot must be freely rotated; when the motion of the foot being communicated to the fibula, pain will be felt, and a crepitus perceived.

For the reduction of this dislocation, which cannot be too soon accomplished, the patient is to be placed upon a mattress properly prepared, and is to rest on the side on which the injury has been sustained; the surgeon is then to bend the leg at right angles with the thigh, so as to relax the gastrocnemii muscles as much as possible; and an assistant grasping the foot, must gradually draw it in a line with the leg. The surgeon then fixes the thigh and presses the tibia downwards, thus forcing it upon the articulating surface of the astragalus. Great force is required if the limb be placed in the extended position, from the resistance of the gastrocnemii; and it is pleasing to observe, that after the most violent attempts have been employed by others, a well-informed surgeon will gently bend the limb, and under comparatively slight extension, return the parts to their natural situation.

Mode of reduction.

When the limb has been reduced it is still to remain upon its Treatment.

outer side in the bent position, with the foot well supported; a many-tailed bandage is to be placed over the part to prevent it from slipping, and this is to be kept wet with an evaporating lotion. Two splints are then to be applied; and each is to have a foot-piece, to give support to the foot, prevent its eversion, and preserve it at right angles with the leg. If much inflammation succeeds, leeches are to be applied to the parts, and the constitution will require relief by taking blood from the arm, and by attention to the bowels; but I shall say no more on this subject until I describe compound dislocation of this joint. A person who has sustained this accident may be removed from his bed in five or six weeks, long straps of plaster being passed around the joint to keep the parts together, and he may be suffered to walk on crutches; but from ten to twelve weeks will elapse before he has the perfect motion of the foot; and much friction and passive motion will be required after the eighth week to restore the natural motion of the joint.

SIMPLE DISLOCATION OF THE TIBIA FORWARDS.

Symptoms.

In this accident, the foot appears much shortened and fixed, the heel is proportionally lengthened and firmly fixed, and the toes are pointed downwards. The lower extremity of the tibia forms a hard projection upon the upper part of the middle of the tarsus, under the projected tendons, and a depression is situated below the tendon Achillis. On dissection, the tibia is found to rest upon the upper surface of the os naviculare and os cuneiforme internum, quitting all the articular surface of the astragalus, excepting a small portion on its fore part, against which the tibia is applied. The fibula is broken, and its fractured end advances with the tibia and is placed by its side: its malleolus externus remains in its natural situation, but the fibula is broken about three inches above it. The capsular ligament is torn through on its fore part. The deltoid ligament is only partially lacerated, and the three ligaments of the fibula remain unbroken. This accident arises from a fall of the body backwards whilst the foot is confined, or from the

Dissection.

Cause.

of a person jumping from a carriage in rapid motion with the toe pointed forwards.

The treatment consists in attending to the following rules. Reduction.
 The patient should be placed in bed on his back; one assistant grasps the thigh at its lower part and draws it towards the body, another pulls the foot in a line a little before the axis of the leg, and the surgeon pushes the tibia back to bring it into its place. Treatment.
 The same principles are held in view in the mode of reduction as in the former, with respect to the relaxation of the muscles. A many-tailed bandage, dipped in an evaporating lotion, must be lightly applied. The local and constitutional treatment is the same as in the dislocation inwards.

As to position, it is best to keep the patient with the heel resting on a pillow, and to have a splint, properly guarded, on each side of the leg, having foot-pieces to keep the foot well supported at right angles with the leg, so as to prevent the muscles again drawing it from its place. As in five weeks the fibula will be united, there will be then no danger in taking the patient from his bed, and gentle passive motion may be begun.

The application of a long splint on each side, with a foot-piece to each splint, and this padded in such a manner as to give the foot a direction inwards, outwards, or at right angles, according to the direction of the dislocation, answers better than any other mode of securing it. When this is applied, the foot cannot escape from the situation in which the surgeon has placed it.

Baron Dupuytren, of the Hotel Dieu, a very eminent surgeon, has recommended a single splint, well cushioned, along the outer or inner part of the leg, according to the direction of the dislocation, and fastened to the leg and foot by bandages.—*See a plate in Johnson's Medico-Chirurgical Review.*

PARTIAL DISLOCATION OF THE TIBIA FORWARDS.

This bone is sometimes partially luxated forwards, so as to rest half on the os naviculare and half on the astragalus. The fibula Symptoms.
 in this accident is broken; the foot appears but little shortened,

nor is there any considerable projection of the heel. The following are the signs of this accident. The foot is pointed downwards, and a difficulty is experienced in the attempt to put it flat on the ground; the heel is drawn up, and the foot is in a great degree immovable.

Case.

The first case of this kind which I saw was in a very stout lady, who resided at Stoke Newington, who had by a fall, as she said, sprained her ancle. When I examined the limb I found the foot immovably fixed, pointed downwards, and attended with great pain just above the ancle. I attempted to draw the foot forwards and bend it, but could not succeed. Some years afterwards I saw this lady at Bishop Stortford, walking upon crutches: her toe was pointed, and she was unable to bring any other part of the foot to the ground; the degree of distortion was less than that which occurs in the complete luxation of the bone forwards: but all tension having now been subdued, the nature of the injury was more evident, though I should not have known it decidedly, without an examination of a foot shewn to me by one of my late apprentices, who was so kind as to give me the parts which were taken from a subject dissected at Guy's Hospital. The articular surface of the lower part of the tibia was divided into two, the anterior part was seated upon the os naviculare, the posterior upon the astragalus; these two articulatory surfaces, formed at the lower extremity of the bone, had been rendered smooth by friction. The fibula was found fractured.

The result of this dislocation clearly proves the necessity which exists in these accidents, however slight they may at first sight appear, of not resting satisfied until the foot be returned into its natural position, and restored to its motion; for, if neglected in the commencement, severe inflammation and tension will prevent even a forcible extension from being afterwards useful; and if still longer neglected, the changes in the state of the muscles, and the union of the fractured fibula, will preclude the possibility of a reduction, even under the most violent attempts. The mode of reduction and after treatment will in no respect differ from that

quired in the perfect dislocation of the bone forwards, either in regard to the relaxation of the muscles, the bandages, or the local and constitutional treatment.

SIMPLE DISLOCATION OF THE TIBIA OUTWARDS.

This luxation is the most dangerous of the three; for it is produced by greater violence, is attended with more contusion of the integuments, more laceration of ligament, and greater injury to the bone, than either of the others. The foot is thrown inwards, and its outer edge rests upon the ground. The malleolus externus projects the integuments of the ancle very much outwards, and forms so decided a prominence, that the nature of the injury cannot be mistaken. The foot and toes are pointed inwards. Symptoms.

In the dissection of this accident, it is found that the malleolus externus of the tibia is obliquely fractured and separated from the rest of the bone. The fractured portion sometimes consists only of the malleolus; at others, the fracture passes obliquely through the articular surface of the tibia, which is thrown forwards and upwards upon the astragalus, before the malleolus externus. The astragalus is sometimes fractured, and the lower extremity of the tibia is broken into several splinters. The deltoid ligament remains unbroken, but the capsular ligament is torn on its outer part. The three fibular-tarsal ligaments remain whole in most cases, but when the fibula is not broken they are ruptured. None of the tendons are lacerated, and internal hæmorrhages scarcely ever occur to any extent, as the large arteries generally escape injury. This accident happens either by the passage of a carriage-wheel over the leg, or by a distortion of the foot in jumping or falling. Dissection.

The mode of reduction consists in placing the patient upon his back, in bending the thigh at right angles with the body, and the leg at right angles with the thigh; the thigh is then grasped under the ham by one assistant, and the foot by another: and as an extension is made in the axis of the leg, while the sur- Reduction.

geon presses the tibia inwards towards the astragalus. The in the simple dislocation, is to be laid upon its outer side, upon splints, with foot-pieces; and a pad is to be placed the fibula, just above the outer ancle, and extending a few upwards, so as in some measure to raise that portion of t and support it; and to prevent the slipping of the tibia and from the astragalus, as well as to lessen the pressure of the leolus externus upon the integuments where they have sus injury.

Treatment.

The local and general treatment will be the same as i former cases, although more depletion is required, as great inflammation succeeds; the greatest care is necessary to preve foot from being twisted inwards, or pointed downwards, as position prevents the limb from being afterwards useful; and precaution is effected by having two splints, with a foot-pie each, padded and applied to the ancle on the outer side of th Passive motion should be given to the joint in six weeks after accident, when the patient may rise from his bed, and be all to walk upon crutches, unless impeded by great swelling a ancle. In the generality of these cases, from ten to twelve v will elapse before the cure is complete.

COMPOUND DISLOCATION OF THE ANCLE-JOINT.

Opening into the joint.

These accidents take place in the same direction as the si dislocations, and the bones and ligaments suffer in the same ner as in those dislocations. The difference, therefore, in t cases is, that the joint is laid open by a wound in the integum and ligaments, opposite to the laceration of the skin, by which synovia escapes, and through which the ends of the bone protr this opening in the integuments is generally occasioned by bone, but sometimes by the pressure of some uneven surface which the limb may have been thrown.

Local effects.

The bones being replaced by the means which are emplc in the simple dislocation, the effects of this accident upon the p composing the joint, are as follow: The synovia, as I have sta

a large wound through the lacerated ligament; in a few inflammation begins; and when an additional quantity of blood is terminated to the part, an abundant secretion issues from the wound, and is discharged through the wound; the ligaments in the inflammation, as well as the extremities of the bones enter into the composition of the joint. The inflammation of the internal secreting surface of the ligament, in about a week proceeds to suppuration; at first but little matter is discharged, but it continues increasing until it becomes very abundant; the lacerated parts of the ligaments and periosteum also secrete. Under this process of suppuration, the cartilages are partially or wholly absorbed, but in general only partially; the ossification of the cartilage is a very slow process, attended with constitutional irritation, and often lays the foundation for the ankylosis of the extremities of the bones. When the cartilage is absorbed, granulations arise from the surface of the bone from the inner side of the ligament; and these inosculate to fill the cavity between the extremities of the bones. We find, after accidents to joints, that the adhesive process is at one part, and that the cartilage is not absorbed; granulations are formed at others, where the cartilage was; and by ulcerations; and I have seen, after inflammation in the joints, that cartilages remain, and their surfaces adhere.

Inflammation and suppuration of the internal ligaments.

this inosculature of granulations, nor the process of ossification leads to permanent ankylosis; for if passive motion is applied as soon as the parts, from cessation of pain and inflammation permit, motion will be restored, not always entirely, but with very little diminution; and the other joints of the tarsus receive such an extent of motion, as to render the deficiency of mobility of the angle-joint but little apparent. The articular ligament is filled by granulations; and with respect to the union of the bones, when they are joined by ossific union, this is effected by the deposit of cartilage, and by a secretion of phosphate of lime, in the usual manner in which bones are repaired.

When passive motion may be applied.

Constitutional
derangement.

Thus, then, the compound dislocation of the ancle, leads to inflammation over a very extensive secreting surface; it produces an extended suppuration over the lining of the joint, occasions much constitutional derangement; and, further, becomes the source of an ulcerative process, more or less extensive according to the treatment pursued; by this the cartilage is either wholly removed, and an irritative fever is supported for a great length of time; and the ulceration sometimes extends to the extremities of the dislocated bones, and leads to a general augmented constitutional irritation, and to protracted disease and exfoliation.

Local and constitutional
effects.

These local effects are accompanied by the common symptoms of constitutional excitement. In two or three days from the accident, or sometimes as early as twenty-four hours, the patient complains of pain in his back and in his head, shewing the influence of the accident on the brain and spinal marrow. The tongue is furred: white, if the irritation be slight; yellow, if greater; and brown, almost to blackness, if it be considerable. The stomach is disordered: there is loss of appetite, nausea, and sometimes vomiting. Secretion ceases in the intestines, and in the glands connected with them, as the liver, &c.; costiveness is therefore an attendant symptom. The skin has its secretion stopped; it becomes hot and dry; the kidneys also have their secretion diminished; the urine is high-coloured, and of small quantity. The heart beats more quickly, and the pulse becomes *hard*, which is the pulse of constitutional irritation from inflammation, and in great degrees of this excitement it becomes irregular and intermittent; the respiration is quicker, in sympathy with the quicker circulation; the nervous system becomes constitutionally affected, in high degrees of local irritation: restlessness, watchfulness, delirium, subsultus tendinum, and sometimes tetanus occur. These are the usual effects of local irritation upon the constitution, occurring in different degrees, according to the violence of the injury, the irritability of the system, and the powers of restoration.

The causes of the violence of these symptoms are, the wound which is made into the joint, and the great efforts required for its repair; for when there is no wound, and the process of adhesion unite the part, little local inflammation or constitutional irritation occur; and if this be the cause of the violence of the symptoms the principle in the treatment of this accident is easily comprehended; it consists in closing the wound as completely as possible, to assist nature in the adhesive process by which the wound to be closed, and to render suppuration and granulation less necessary for the union of the opened joint.

Cause of the symptoms.

Principle of cure.

The first question which arises upon this subject is the following: *Is amputation generally necessary in compound dislocations of the ankle?* My answer is, certainly not. Thirty years ago it was the practice to amputate limbs for this accident; and the operation was then thought absolutely necessary for the preservation of life by some of our best surgeons; but so many limbs have been saved in late years, indeed, I may say, so great a majority of these cases exist, that such advice would now be considered not only injudicious, but cruel. It is far from being my intention to state that amputation is never required; I have only to observe, that in a great number of these accidents the operation is unnecessary.

Is amputation required?

But before I give the proofs of what I have advanced, I shall state the mode of treatment which is to be pursued in these cases.

When the surgeon examines the limb, he finds a wound of greater or less extent, according to the degree of the injury. The extremity of the tibia projects if the dislocation of the tibia be forwards; and the tibia and fibula are protruded, if the dislocation of the former be at the outer angle. The ends of the bones are often covered with dirt from their having reached the ground. The foot is loosely hanging on the inner or outer side of the leg according to the direction of the dislocation. Sometimes, though very rarely, a large artery will be divided; and it is surprising that the posterior tibial artery so generally escapes laceration; the anterior tibial being the only vessel I have known to be torn. The first object of hæmorrhage is the first object; and for this purpose, if

Treatment.

Artery divided.

the anterior tibial artery be wounded, it must be secured by ligature. The extremity of the bone is to be washed with warm water, as the least extraneous matter admitted into the joint will produce and support a suppurative process; and the utmost care should be taken to remove every portion of it adhering to the end of the bone.

Loose pieces of bone.

If the bone be shattered, the finger is to be passed into the joint, and the detached pieces are to be removed: but this is to be done in the most gentle manner possible, so as not to occasion unnecessary irritation. If the wound be so small as to admit the finger with difficulty, and if small pieces of bone can be felt, the integuments should be divided with a scalpel, to allow of such portions being removed without violence; the incision should be so made as to leave the joint with as much covering of integument as possible. The integuments are sometimes nipped into the joint by the projecting bone; and then it cannot be reduced without making an incision, to allow the skin to be drawn from under the bone; and when the edges of the incised wound are afterwards brought together, no additional evil arises from the extension of the wound.

Integuments.

Reduction.

The mode of reducing the bone is in other respects, similar to that which I have already described when speaking of simple dislocation; by bending the leg upon the thigh, so as to relax the muscles before the extension is made. When the bone has been reduced, a piece of lint is to be dipped in the patient's blood, and applied wet over the wound, upon which the blood coagulates, and forms the most natural, and, as far as I have seen, the best covering for the wound. A many-tailed bandage is then applied, the portions of which should not be sewn together, but passed under the leg, so that any one piece may be removed when it becomes stiff; and by fixing another to its end, the application may always be renewed without any disturbance to the limb; this bandage is to be kept constantly wet with spirits of wine and water. A hollow splint, with foot-piece at right angles, is to be applied on the outer side of the leg, in the dislocation inwards, and the leg is to

rest upon its outer side : but in the dislocation outwards, it is best to keep the limb upon the heel, with a splint and foot-piece both upon the outer and the inner side ; and an aperture in the splint opposite the wound.

In each dislocation the patient's knee is to be slightly bent, to relax the gastrocnemius muscle. The foot must be carefully prevented from being pointed ; great care being taken to preserve it at right angles with the leg, otherwise the limb will be useless when the wound is healed. The patient is to be placed on a mattress, and a pillow is to reach from half way above the knee to beyond the foot, and another is to be rolled under the hip, to support the upper part of the thigh-bone.

Constitutional
treatment.

Blood-letting must be adopted, or not, according to the powers of the constitution ; as it is necessary to bear in mind, that the patient has a great trial of his powers to undergo, and will require throughout the process of restoration, all the support which his strength can receive. Purgatives must also be used with the utmost caution ; for there cannot be a worse practice, when a limb has been placed in a good position, and adhesion is proceeding, than to disturb the processes of nature by the frequent changes of position which purges produce ; and I am quite sure, that in cases of compound fracture, I have seen patients destroyed by their frequent administration. That which is to be done by bleeding, and emptying the bowels, should be effected as soon as is possible after the accident, before the adhesive inflammation arises ; after which the liquor ammoniæ acetatis, and tinctura opii, form the patient's best medicine, with a slight aperient at intervals.

Blood-letting.

Purging.

If the patient complain of considerable pain in the part, in four or five days, the bandage may be raised to examine the wound ; and if there be much inflammation, a corner of the lint should be lifted from the wound, to give vent to any matter which may be formed ; but this ought to be done with great circumspection, as there is danger of disturbing the adhesive process, if that be proceeding without suppuration. By this local treatment, it will every now and then happen that the wound will be closed by adhesion ;

Secondary
treatment.

but if in a few days it be not, and if suppuration take place, the matter should have an opportunity of escaping; and the lint being removed, simple dressing should be applied. After a week or ten days, if there be suppuration with much surrounding inflammation, poultices should be applied upon the wound, leeches in its neighbourhood, and upon the limb at a distance, and the evaporating lotion should be still employed; but as soon as the inflammation is lessened; the poultices should be discontinued, as they encourage too much secretion, and relax the blood-vessels of the part, so as to prevent the restorative process.

Result.

If the cure proceeds favourably, in a few weeks the wound is healed with little suppuration; if less favourably, a copious suppuration takes place, the wound is longer in healing, and exfoliation of portions of the extremity of the bone still further retards the cure. The motion of the joint is not always lost; it is sometimes in a great degree restored: but this depends upon the greater or less extent of suppuration or ulceration. Under the most favourable circumstances, three months generally elapse before the patient can walk with crutches; in many cases, however, a greater length of time is required: he bears upon the limb at different periods of time, according to the degree of injury sustained, as in compound fracture, when adhesion is not at first produced. In compound dislocations, of course, the patient is longer in recovering.

I shall now proceed to state the cases which have induced me to say that amputation, as a general rule, is improper.

The circumstance which led me to doubt the soundness of the opinion which recommended indiscriminate amputation, was these:

Case.

I was, many years since, going into the country with a friend of mine, and we met with a surgeon in our journey who put this question: "How do you act in compound dislocations of the ankle-joint?" I do not recollect the reply, but he proceeded to say, "I have had a case of compound dislocation of the ankle-joint under my care, in which I told the patient he must lose his limb."

not approving this advice, his friends sent for another surgeon, who said he thought he could save it: the patient placed himself under his care, and the man is recovering."

About thirty years ago, I received from Mr. Lynn, of Wood-ridge, now Dr. Lynn, of Bury St. Edmunds, the astragalus of a man broken into two pieces which he had taken from a dislocated ancle-joint. His letter is as follows:—

Dear Sir,—J. York, aged thirty-two years, being pursued by some bailiffs, jumped from the height of several feet to avoid them. The tibia and a part of the astragalus protruded at the inner ancle. I immediately returned the parts into their natural situation. Suppuration ensued; and in five weeks a portion of the astragalus separated, and another piece a week afterwards, which, when joined, formed the ball of that bone. In three months the joint was filled with granulations; it soon afterwards healed, and the man recovered with a good use of the limb. Case.

I attended a compound dislocation of the ancle-joint, in the year 1797, with Mr. Battley, which I relate in his own words.

"In the month of September, 1797, a gentleman lodging in Duke-street, Smithfield, in a fit of insanity threw himself from a two-stair window into the street, his feet first reaching the ground. He rose without help, knocked violently at the outer door of the house, and ascended the stairs without the least assistance, bolted the door after him and got into bed. He refused to open the door, and it was obliged to be forced. A neighbouring surgeon was sent for, who, on viewing the case, proposed an immediate amputation, which was not acceded to by his friends; but Mr. Cooper and myself were requested to take charge of the case. On examination there was found a compound dislocation of the ancle-joint. The tibia was thrown on the inner side of the foot; and when the finger was passed into the wound, the astragalus was discovered to be shattered into a number of pieces. The loose and disconnected portions of bone were removed, and the tibia was replaced; after which, lint, dipped in the oozing blood, was wrapped Case.

around the lacerated parts, and the limb was placed on its outer side, with the knee considerably bent. The parts were ordered to be kept cool by the frequent application of evaporating lotion.

The patient remained as quiet as could be expected from a person in his state of mind until the third or fourth day, when a considerable inflammation appeared in the joint, and greatly increased the previous irritable state of his constitution. Leeches, fomentations and poultices were applied to the limb; blood was taken from the arm, purgative medicines were given, and afterwards saline medicines with sudorifics. Extensive suppuration ensued, and continued for six weeks or two months, when it began to lessen, and healthy granulations appeared on the whole wounded surfaces; about this time the state of his mind began to improve, and it continued to amend as his leg advanced in recovery. At the end of four or five months the suppurated parts had filled up, the joint healed, and his mind recovered its natural tone. At the end of nine months he returned to his employment, but the ankle-joint was stiff. In two years he had so far recovered as to walk without the aid of a stick; and at the end of three or four years was able to pursue his avocations nearly as well as at any former period of his life.

Mental symptoms improve.

REMOVING THE ENDS OF THE BONES.

Sawing off the ends of the bones.
Reasons.

There is another mode of treatment in these accidents, which consists in sawing off the extremity of the tibia before the bone is returned into its natural situation; and the reasons which may be assigned for pursuing this practice are as follow.

Difficult reduction.

First. There is in some cases much difficulty in the reduction of the tibia, and great violence must be employed to effect it.

Oblique fracture.

Secondly. The extremity of the bone is often broken obliquely, so that when reduced it will not remain upon the astragalus, but when the point is removed by the saw, it rests without difficulty upon that bone.

Thirdly. The spasmodic contractions of the muscles are much diminished by shortening the bone, as it throws them all into a state of relaxation; whereas, if the bone be reduced by violence when the saw has not been used, the spasm of the limb will be sometimes very violent.

Fourthly. The local irritation is much diminished by the greater ease with which adhesion is produced of the sawn extremity of the bone to the parts to which it is applied; for it is a mistake to suppose that the sawn end of the bone will not adhere; the contrary is seen in amputation, in sawing off the bone in exostosis, and in the union by adhesion of compound fractures; and that adhesive matter can be thrown out upon cartilaginous surfaces is known to every person who has dissected a diseased bone; it is thus that the end of the tibia adheres to the surface of the astragalus.

Fifthly. When suppuration does occur it is much diminished, and a considerable part of the ulcerative process is prevented by the mechanical removal of the cartilage; for nearly half the articular surface of the joint no longer remains. *Cæteris paribus*, therefore the case recovers more rapidly.

Sixthly. The constitutional irritation is very much lessened by the diminution of the suppurative and ulcerative process, and by the greater ease with which the parts are restored. In the cases which I have had an opportunity of seeing, there was not more irritation after than in the mildest cases of compound fracture.

Seventhly. It has been found that in cases in which the extremities of the bones forming the joint have been broken into small pieces, and in which these have been removed by the finger, the patient has suffered less, and has more quickly recovered, than when the bone has been returned whole.

Eighthly. I have known no case of death when the extremities of the bones have been sawn off, although I have occasion to mention some in which the cases terminated fatally when this was not done.

Local irritation diminished.

Suppuration and ulceration lessened.

Less constitutional irritation.

Bone shattered.

No case of death.

Objections.**Limb shorter.**

The objections which may be made to this mode of treatment are, that the limb becomes somewhat shorter by the removal of the cartilaginous extremity of the bone; but this I do not think an objection of any considerable weight, if the danger of the case be, as I believe, lessened by it: for the diminished length, which is very slight, is easily supplied by a shoe made a little thicker than usual.

Anchylosis.

The other objection is, that the joint becomes necessarily ankylosed. I doubt very much the reality of this objection, as in two instances I have seen the motion of the part remain; but even when the joint becomes ankylosed, a consequence to which it is liable in either mode of treatment, the motion of the tarsal bones becomes so much increased as to compensate for that of the ankle, the patient walks with much less halting than would be anticipated, and has a very useful limb.

Each mode useful.

My intention, however, is not to advocate either mode of treatment to the exclusion of the other, but to state the reasons which may be justly assigned for the occasional adoption of either. It is only by a comparison of the different results of varied practice that a safe conclusion can be drawn; and from what I have had an opportunity of observing in my own practice, and of learning from that of my friends, I feel disposed to recommend to those whose minds are not settled upon the subject, not hastily to determine against either treatment in the different cases of this injury, as from each mode, under varied circumstances, a strong and useful limb has been saved without any additional risk to the life of the patient.

Cases in which the one or the other should be employed.

If the dislocation can be easily reduced without sawing off the end of the bone; if the bone be not so obliquely broken, but remain firmly placed upon the astragalus when reduced; if the end of the bone be not shattered, for then the small loose pieces of bone should be removed, and the surface of the bone be smoothed by the saw; if the patient be not excessively irritable, so as to occasion the muscles to be thrown into violent spasmodic action in the attempt at reduction, which leads to subsequent displacement when

the limb has been reduced; the bones should be at once returned into their places, and the parts should be united by the adhesive inflammation; but rather than amputate the limb, if the above circumstances were present, I should certainly saw off the ends of the bones.

I shall now proceed to state the cases which I have myself had an opportunity of witnessing, and some which have been furnished by my friends, and shall leave the reader to judge of the propriety of the advice I have given.

COMPOUND DISLOCATION OF THE TIBIA INWARDS.

Mr. Charles Averill, dresser to Mr. Forster, Surgeon of Guy's Case. Hospital, had the kindness to send me the following particulars of a case, the progress of which I often witnessed with pleasure.

John Williams, sailor, aged thirty-eight, a very robust man, was brought into Guy's Hospital, under the care of Mr. Forster, August 9th, 1819, at four o'clock in the morning, with a compound dislocation of the right ankle inwards, and considerable injury to the left, occasioned by his falling from a height of about twenty-six feet, in endeavouring to escape from the Borough Compter in which he was imprisoned. On examining the injured part, I found the tibia protruding three inches through a large transverse wound of four inches in extent, and resting on the inner side of the os calcis; the cartilaginous surface of the astragalus could be readily felt on passing my finger into the wound; the fibula was broken. I first sawed off the whole of the cartilaginous end of the tibia, when the bone was easily replaced; the edges of the wound were then brought as much in contact as possible; lint dipped in blood was applied, and over it straps of adhesive plaster; the foot and leg were wrapped in cloths wet with a lotion of acetate of lead, and the limb was laid on its side. He complained of great pain in the left leg, which was very much swollen all around the ankle; ten leeches were applied to it, and afterwards the liquor plumbi

subacetatis dilutus, which relieved the pain; thirty drops of laudanum were given, and he remained easy. On the following day sixteen ounces of blood were taken from him, and five grains of calomel were given. On the 12th, the dressings were removed; the wound looked well. On the 17th, a suppuration had commenced; and the discharge having rather a foetid smell, the nitric acid lotion was applied*. September 2nd, the matter gravitating to the outer side of the leg, an opening was made, by which it was discharged, and adhesive plaster applied to the original wound, which was healing fast; the discharge gradually diminished; and on the 21st of September, six weeks from the accident, both wounds were quite healed. He has not yet left his bed. There is motion at the ancle: the toe turns out but very little, and does not point downwards. He wears splints, and the strength of the limb is daily increasing. When the swelling of the left ancle diminished, a fracture of the external malleolus was also there discovered.

This man escaped from the hospital on the 24th of October, was retaken two months afterwards, and conveyed to the Borough Compter. He has free motion of the right ancle, and suffers more from the injury to the left.

DISLOCATION OF THE ANCLE FORWARDS.

Case.

My dear Sir:—I have much pleasure in sending you an account of the case I mentioned to you last night, together with a sketch by which I have endeavoured to shew the position of the limb at the time when I saw the patient.

James Price, aged thirty-nine, a very robust man, was coming to town on Monday, the 1st of March, in a light cart drawn by one horse. In passing through Clapham the horse ran away, and

* The nitric acid lotion, during the sloughing process, is the best application with which I am acquainted. I order it in the proportion of fifty drops of the acid to a quart of distilled water, apply it by linen covered with oiled silk.

falling, overturned the cart, and threw Price's legs under one of the shafts; in endeavouring to extricate himself he received a severe injury to the right ancle. By the direction of Mr. Parratt, he was immediately conveyed to St. Thomas's Hospital, where I saw him; and on examination found that the tibia had been dislocated forwards and a little inwards, its inferior extremity resting on the fore part of the astragalus and os naviculare: the deltoid ligament must have been torn through, as the inner malleolus was not fractured. The heel projected very considerably, and the foot was turned outwards in a slight degree and downwards, the toes being pointed. The fibula was fractured about two inches above the external malleolus, at which part there was a considerable depression. The reduction was very easily accomplished by flexing the leg on the thigh, which was firmly held by my dresser, Mr. Campbell, as I drew the foot downwards and forwards, and pressed the tibia backwards. The limb was placed in the flexed position, on the heel; since which time the patient has been perfectly tranquil, and the limb remains in its proper position.

Experiment.

I was anxious to ascertain what steps nature pursued in order to restore a part in which the extremity of a bone, forming a joint, had been sawn off; and I therefore instituted the following experiment.

I made an incision upon the lower extremity of the tibia, at the inner ancle of a dog, and cutting the inner portion of the ligament of the ancle joint, I produced a compound dislocation of the bone forwards. I then sawed off the whole cartilaginous extremity of the tibia, returned the bone upon the astragalus, closed the integuments by suture, and bandaged the limb to preserve the bone in this situation. Considerable inflammation and suppuration followed; and in a week the bandage was removed. When the wound had been for several weeks perfectly healed, I dissected the

limb. The ligament of the joint was still defective at the part at which it had been cut. From the sawn surface of the tibia there grew a ligamento-cartilaginous substance, which proceeded to the surface of the cartilage of the astragalus, to which it adhered. The cartilage of the astragalus, appeared to be absorbed only in one small part; there was no cavity between the end of the tibia and the cartilaginous surface of the astragalus. A free motion existed between the tibia and astragalus, which was permitted by the length and flexibility of the ligamentous substance above described, so as to give the advantage of a joint where no synovial articulation or cavity was to be found. This experiment not only shews the manner in which the parts are restored, but also the advantage of passive motion: for if the part be frequently moved, the intervening substance becomes entirely ligamentous; but if it be left perfectly at rest for a length of time, ossific action proceeds from the extremity of the tibia into the ligamentous substance, and thus produces an ossific anchylosis.

CASES WHICH RENDER AMPUTATION NECESSARY.

Cases requiring amputation.

But still cases occur in which amputation is found absolutely necessary, either to preserve the life of the patient, or to prevent him being doomed to the constant necessity of using crutches on account of the deformity and stiffness of the limb.

Does not always succeed.

It seems to me, however, to be by much too prevailing an opinion, that the amputation of the limb is a sure means of preserving life; for when this operation used to be more frequently performed in our hospitals than it now is, for compound dislocation of the ancle and compound fracture of the leg, a considerable number of our patients died. Very lately a man at Tring had his foot torn off by a threshing machine, and the limb was obliged to be amputated at the usual place below the knee. The operation was performed by Mr. Firth, but the man died in the evening of the sixth day: and a case has occurred since I commenced the publication of this work, of equally fatal termination.

The circumstances which I have known to create this necessity are,—

I. The advanced Age of the Patient.

At an advanced age the powers of the body become so much **Age-**
weakened, that the patient is unable to bear the constitutional ex-
citement which the suppurative inflammation of the joint produces;
and as amputation does not expose him to this process, it is better
to have recourse to that operation. However, I ought to observe,
that when in my lectures I stated what I have now advanced, the
pupils flocked around me after lecture, and have told me of cases
of recovery, even of very old persons; but in the practice of hos-
pitals in this great metropolis, very aged persons sink under these
accidents, if the limb be not amputated.

*2. A very extensive lacerated Wound will give rise to a necessity
for this Operation.*

*3. A difficulty in Reducing the Bones has been considered as a
reason for Amputation.*

This circumstance, however, is rather a motive for removing the **Difficult reduc-**
extremities of the bones by the saw, than for performing amputa-
tion; after which removal, the reduction of the tibia is easily
effected, and a useful limb is preserved to the patient. **tion.**

4. The Bones are sometimes extremely shattered.

If the lower extremity of the tibia be broken into small pieces, **Bones shattered.**
the loose portions of bone ought to be removed, and the end of the
tibia to be smoothed by a saw; but if, in addition to this commi-
nution, the lower extremity of the tibia be obliquely broken, and a
large loose portion of bone be felt with the fingers, then it
will be proper to amputate: also, if the astragalus be broken,
the portions of this bone should be removed, otherwise they
will separate by ulceration, or occasion considerable local irri-
tation. But if the end of the tibia and the tarsal bones, as

the astragalus and os calcis, are broken, then amputation will be required.

5. *The Dislocation of the Tibia at the Outer Ankle,*

Dislocation
outwards.

Produces much more injury and danger than that at the inner, and amputation will be more frequently required for it, because both the bones and soft parts suffer more than in the dislocation inwards.

6. *It sometimes happens, that when the Bone is replaced it will not remain in its Situation, and all the Symptoms of the Injury become renewed.*

Oblique fracture
with dislocation.

This circumstance arises when the tibia, in the dislocation outwards, is obliquely broken; and as only a small portion of the articulating surface remains on the dislocated extremity of the tibia, it will not rest on the tibia when it is reduced.

7. *The Division of a large Blood-vessel might, with an extensive Wound of the Integuments, lead to a necessity for Amputation.*

Division of an
artery.

But I should not, on that account, at once proceed to the operation. The case from Mr. Sandford, of Worcester, sent me by Mr. Carden, clearly shews that the division of the anterior tibial artery does not, if it be well secured, prevent the patient's recovery. I also once saw a compound fracture close to the ankle-joint, accompanied by a division of that artery; yet, although the patient was in the hospital, and being a brewer's servant possessed the worst constitution to struggle against severe injuries, this man recovered without amputation.

The posterior tibial artery is a vessel of more importance, and is accompanied by a large nerve, which would not be likely to escape injury when the artery was divided by the dislocated bone. Yet the magnitude of the anterior tibial artery, and its free anastomosis with the posterior, would not entirely preclude the hope of preserving the foot under an injury of the posterior tibial artery.

8. *Mortification of the Foot,*

Sometimes ensues, and becomes a sufficient reason for amputat- Gangrene.
 ing the limb; but this must generally be done when limits appear
 to be set to the extension of the mortification. However, it may
 be observed, that in the mortification which ensues from the
 division of a blood-vessel, where the brachial artery had been
 divided, and the elbow-joint dislocated, I have seen the arm
 removed above the injured part, while the limb was still dying to-
 wards the seat of the wounded artery, and the patient was
 restored to health. And I have also known a case of popliteal
 aneurism, in which the artery and surrounding parts were so com-
 pressed by the swelling, that mortification began at the foot, and
 was extending to the knee; and, although no limit was yet set to
 the mortification, the limb was amputated, and the patient re-
 covered. So that mortification, when it arises from injury to a
 blood-vessel, or other local injury, in a healthy constitution, admits
 of a practice different from that which is pursued in mortification
 arising from constitutional causes.

Excessive Contusion may be another reason for Amputation;

And therefore in those cases in which heavy laden carriages pass Contusion.
 over joints and bruise the integuments so as to occasion the forma-
 tion of extensive slough, and produce at the same time, generally,
 the worst examples of compound dislocation, in regard to the state
 of the bones, I should immediately amputate; for such cases are
 very different from those which are caused by jumping from a con-
 siderable height, from a carriage rapidly in motion, or by a fall in
 walking or running.

Extensive Suppuration will also be a reason for Amputation.

I have known, after an attempt to save the limb, the patient have Suppuration.
 more extensive suppuration than his constitution could support,
 followed by an ulceration of the ligaments, by which the joint be-
 came additionally exposed, and the bones were again displaced:

hence there arose an absolute necessity to remove the limb for the preservation of his life.

9. *A necessity for Amputation may also be produced by Exfoliations of Portions of Bone, which,*

Exfoliation.

While locked in the surrounding parts of the bone, are incapable of becoming separated, and thus keep up a state of continuous irritation. My friend, Mr. Hammick, had the kindness to send me a specimen of this kind, which he was obliged to amputate. The loose portion of bone was seated between the lower extremities of the tibia and fibula, and reached to the ankle joint; both the bones had been broken, and had become re-united, and the union medium had inclosed and incarcerated the dead portion of bone. It is probable, from the appearance of the parts, that this portion of bone never would have been able to escape from the place in which it was locked.

10. *Excessive Deformity of the Foot,*

Deformity.

Will also give rise to a necessity for amputation; and this deformity will take place in three directions. First, when the foot is suffered to turn outwards, whilst the leg is placed upon the heel is the dislocation inwards. Secondly, when it is turned inwards; and, thirdly, when the foot remains pointed. The first is best opposed by placing the leg upon its outer side, when that is compatible with the treatment of the wound; in the second case, it is best to keep the foot on the heel; and in both cases, splints having a foot-piece both on the inner and outer side of the foot, must be applied; the third requires similar splints, and a tape as a stirrup, placed under the foot, and fastened to the splint on the fore and middle part of the leg to keep the foot supported. The splints should be so padded as to preserve it in its proper direction.

The following case from Mr. Norman, of Bath, shews the necessity for amputation, when great deformity is permitted to occur.

Case.

I was sent for to Bradford, some years since, to amputate a leg

directly after an accident of this kind. I found the lower extremity of the tibia, with the astragalus loosely attached to it, projecting at the inner ancle. The wound was not large, and the soft parts were little injured. I removed the astragalus, and reduced the tibia, leaving it to rest on the os calcis. I did not again see my patient during the healing of the wound; I believe it got well without any severe symptoms, but the os calcis was drawn up against the posterior part of the tibia, to which it firmly united, and the foot became immoveable, with the toe pointed downwards. In this state he came to Bath two years afterwards, when I amputated the leg, and the patient did well.

GEORGE NORMAN.

Bath, August, 2d, 1819.

11. *Amputation has been recommended in those Cases in which Tetanus occurs after this Injury.*

Of tetanus I have seen one case from compound dislocation of the ancle, and have heard of another. That which I saw was in Mr. Yare, stable-keeper, who had a compound dislocation of the tibia inwards, and in whom I reduced the bones, and placed the limb on its outer side. For a few days he proceeded without any alarming symptoms. The only circumstance in which his case differed from what I expected, was in the slight inflammation which succeeded upon the joint; for the restorative process seemed to be scarcely established in him. When I paid him my morning visit, several days after the accident, he said, "Sir, believe I have caught cold, for my neck is stiff:" and as he said this with his jaws closed, I begged him to shew me his tongue, to ascertain if the jaw was locked: and he tried to open his mouth, but was unable to do so. I then desired that Dr. Ralph might see him, who did all that his mind could suggest to arrest the progress of the symptoms, but unsuccessfully, as the different muscles of volition became affected in the back, the extremities and the abdomen, until he was exhausted by irritation. To amputate under such circumstances would be most unjusti-

fiable, as far as the experience of cases in this climate will enable me to form an opinion.

I have not seen amputation performed for compound dislocation of the ancle, but I have seen it performed for compound fracture just above the joint, and it seemed to me to precipitate the fatal event. I have also known, in one case, the finger amputated for tetanus arising from injury to it, yet the patient died ; and I have also heard of a third case in which it was practised, but still the issue was fatal.

There is a species of *chronic tetanus*, which sometimes even succeeds wounds, and which will occasionally subside, and apparently the patient will recover, although little be done by medicine, and nothing by surgery ; in such cases it would not be justifiable to amputate.

If any medicine be efficacious, *submurias hydrargyri*, with opium, is that under which I have seen the majority of these cases recover : and opium should also be applied to the wound.

12. *A very irritable State of Constitution,*

Constitution
irritable.

Will sometimes render all treatment unavailing to save the limb, and will now and then prove destructive, even if the operation be performed. There are some persons originally constituted with so irritable a system, that the slightest injuries will destroy them. There is a much greater number whose constitutions, originally good, have been so much injured by excess, by want of exercise, by over exertion of mind, drinking freely of spirits and eating but little, that to them the slightest accidents prove fatal.

One of the most curious examples of this kind which I have seen, was the following.

Case of Barclay's
drayman.

A man who worked at Barclay's Brewhouse, in the Borough was, on Saturday, turning a cask, when a splinter of wood entered his thumb, which he immediately drew out. The following night he requested his wife to rise and make him a poultice ; for his thumb, he said, was painful.

On Monday he sent for Mr. John Kent, surgeon in the Borough.

who found his thumb inflamed and painful. Tuesday the inflammation had extended to the hand and fingers. Wednesday a swelling appeared at the wrist, above the ligamentum annulare carpi, and the man had a great deal of irritative fever, and was obliged to keep his bed.

On Thursday, after lecture, Mr. Kent came to me, requesting I would see this man, who had been delirious during the night : his arm being much convulsed, and his body becoming generally so. I went with Mr. Kent, and feeling the thumb, discovered a fluctuation in the theca. I put a lancet into the extremity of the thumb, and a considerable quantity of pus issued. Gratified with the expectation of his being relieved by the discharge of the matter, I was going out of the room to express this feeling to his friends, when I heard a rustling on the bed behind me ; and upon Mr. Kent and myself turning back, we saw him under the influence of a convulsive fit, which raised him in his bed, and in which he fell back and expired.

Living as these persons generally do, principally upon porter and spirits, they have constitutions which render them the worst subjects for accident.

Persons who are much loaded with adeps are generally very irritable, and bear important accidents very ill ; indeed they frequently perish, whatever plan of treatment be pursued. To this statement, however, there are exceptions in those who, though corpulent, are still in the habit of taking much exercise, as they will retain some vigour of constitution ; and in such persons the limb may be attempted to be saved, as in the case described by Mr. Abbott, surgeon of Needham Market ; but in those who have become extremely fat, and who have been addicted to habits of indolence, there is but little chance of preserving life but by amputation.

Corpulent persons.

Having thus endeavoured to explain what has fallen under my own observation, and what I have been able to learn from others upon this difficult subject, I beg to express a hope, that any of my friends, who may have had cases under their care which would

Invitation to correspondence on the subject.

throw further light upon the subject, will have the kindness to communicate them to me, whether they make for or against the advice that I have given, as I have no further wish but that all the points respecting this severe accident may be fully elucidated and established ; and shall only add, that the observations which I have made in favour of saving the limb in compound dislocations of the ancle-joint, will apply much more strongly in country practice than in that of the large hospitals in London.

The Ankle is sometimes dislocated by Ulceration.

Case. September 23d, 1823. With Mr. Dixon, surgeon, of Kennington, I visited Mr. P., a patient of his, who had a dislocation of the ankle produced by ulceration. An ulcer existed at the inner ankle, which had discharged synovia. The ankle-joint was red and greatly swollen, the foot drawn outwards by the action of muscles, and the internal malleolus thrown inwards upon the astragalus. The tibial arteries were greatly stretched ; and the fibula, by its pressure on the malleolus externus, produced considerable and constant pain. Mr. P. is a very old man, and dying of the disease.

FRACTURES OF THE TIBIA AND FIBULA NEAR THE ANCLE-JOINT.

Fracture of the fibula.

The *fibula* is frequently broken from two to three inches above the ankle joint, and the patient instantly becomes conscious of the accident by feeling a snap a little above the outer ankle ; by the pain which he suffers in his attempt to bear upon the foot ; by his inability to place his foot flat upon the ground, resting it rather on the inner side to throw the bearing of the body upon the tibia ; and by pain and a sensation of motion at the injured part when the foot is bent or extended. The surgeon discovers the nature of the accident by rotating the foot with one hand, and by grasping the lower part of the leg with the other ; at each rotation a crepitus is generally felt. There is also frequently an inequality of the bone at the broken part, which assists in pointing out the nature of the injury.

the cause of this injury is a blow upon the inner side of the foot, or some violence which forces it outwards against the lower extremity of the fibula; and I have known it broken by distortion of the foot inwards. A fall laterally, whilst the foot is confined in a narrow cleft, produces this accident. I broke my right fibula by a fall on my right side whilst my right foot was confined between the pieces of ice, and I could with difficulty support myself to a neighbouring house by bearing upon the inner side of my foot. I returned home in a carriage, and every jolt of it gave me pain at the injured part as I suspended my leg upon my hand. I knew that the bone was broken by the severe snap which I felt in the part at the moment of the accident.

Its cause.

The treatment which this injury requires is, to apply a many-layered bandage upon the limb, and to keep it wet with a lotion of Rini, ℥ aquæ ℥ v.: to apply a splint, with a foot piece upon the inner side, padded with cushions in such a manner as to preserve the great toe in a line with the patella, an invariable rule on these occasions; and to place the leg upon its side in the semiflexed position, so as to relax the muscles, and render the patient's position as easy as possible.

Its treatment.

Neglect of attention to the treatment of this accident leads to permanent lameness. Dr. Blair, a naval physician in the American navy, informed me that he found great difficulty in walking the streets of London on one side of the way, but upon the other he walked better than upon flat ground: and when I remarked his lameness, and inquired into its cause, he informed me, it had resulted from a fracture of the fibula, which happened many years ago, and to which not having applied splints, the foot became deformed, so that he walked better upon an inclined plane than upon level ground.

Lameness from neglect.

FRACTURES OF THE TIBIA AT THE ANCLE-JOINT.

The tibia is often broken into the ancle-joint, or through the bone a little above it; and these fractures pass rather obliquely upwards, or obliquely outwards; the first in a line from the usual

Fracture of the tibia.

seat of fracture of the fibula, that is, from one to two inches above the external malleolus to the inner ancle; the second from one to two inches of the tibia above the ancle, downwards and outwards into the joint.

Diagnosis.

The first is distinguished by crepitus at the ancle when the foot is rotated, bent, or extended; and by a slight inclination of the foot outwards. If the fracture does not enter the joint, but obliquely crosses the tibia above it, the lower part of the tibia slightly projects over the malleolus internus.

Treatment.

The treatment in this case consists in using evaporating lotions; the many-tailed bandage; splints with a foot-piece to each, padded so as to incline the foot inwards, and to bring the toe into its natural line with the patella, which is easily effected with the splints to which I have alluded.

Oblique fracture.

The symptoms of the oblique fracture of the tibia downwards and outwards into the joint are, as in the former case, a crepitus upon rotation, flexion, and extension; but the foot is slightly inclined inwards, and the malleolus externus projects more than it naturally would. The same bandages and splints are to be used as in the former case; and the position in both these accidents should be as follows:

Treatment.

The leg should be raised so as to bend and elevate the knee; and the knee should rest upon the gastrocnemius muscle, and upon the heel. The splints will support the foot on each side, and the leg should be supported by a pillow, reaching from the knee to beyond the foot, secured by tapes around it. I have seen both these cases do well when the patient and his leg rested upon the outer side: but the advantage of placing the limb upon the heel is, that it gives the surgeon an opportunity of observing the least deviation in the line of the foot, relatively to the axis of the leg; and this is also an easier position to the patient.

Dislocation upwards from fracture.

The outer portion of the lower extremity of the tibia, at the part at which it joins the fibula, is sometimes fractured and split off from the shaft of the bone in jumping from a considerable height; the foot then rises between the tibia and fibula; a dislocation

of the tibia inwards is produced, and the foot is elevated between the two malleoli. The treatment required in this case is the same as in the dislocation inwards.

Oblique compound fractures into the ankle-joint generally do well if care be taken to produce adhesion of the wound, which is to be effected by applying lint, imbrued in blood, to the lacerated skin, and by leaving it there until it separates spontaneously. The same bandages and splints are required as in simple fractures, but the position must be varied according to the situation of the wound. Even if suppuration occurs the patient will generally recover, unless he be much advanced in years.

Oblique compound fractures.

But if, with compound fracture into the joint, there be much comminution of bone, and hæmorrhage from any large vessel, it will be proper to amputate immediately, more especially if the patient be obliged to obtain his bread by his labour; for after recovery, under great comminution, the limb will bear but slight exertion.

DISLOCATION OF THE TARSAL BONES.

SIMPLE DISLOCATION OF THE ASTRAGALUS.

The astragalus is connected above and on each side with the tibia and fibula by its trochlea; below it has articular surfaces for its junction with the os calcis, to which it is united by means of a capsular and strong interosseous band of ligament; and anteriorly to the os naviculare, by a capsular, broad, and internal lateral ligament. A simple dislocation of the astragalus sometimes, though rarely, occurs; a compound luxation is still more rare.

Junction with other bones.

A simple luxation of the astragalus is a most serious accident, being very difficult to reduce; and should the reduction not be effected, the patient is ever after doomed to a considerable degree of lameness.

Simple dislocations.

Being sent for into the country to visit a patient, the surgeon, Case.

Mr. James, of Croydon, whom I met there, requested me to see a gentleman who had a dislocation of the foot, which had happened several weeks before, but had not proceeded to his satisfaction. Upon examination, I found the astragalus dislocated outwards, and the tibia broken obliquely at the inner malleolus. Every attempt to reduce it was made which Mr. James, who is an extremely well-informed man, could adopt; five persons kept up a continued extension when the accident first happened, but without effect; the patient was then taken home, and several persons were employed in extending the foot, and it was thought, after a time, with some success; but the reduction could not, by all their efforts, be rendered complete, as the astragalus still remained projecting upon the upper and outer part of the foot. The extension could not be carried further; the integuments sloughed from that which had been already made; and the wound was a long time in healing. The limb now deviates much from its natural shape; the toes are turned inwards, and pointed downwards; there is some little motion at the ankle, and only a slight degree of it between the projecting and raised astragalus and the other bones of the tarsus.

This accident, then, is of a most serious nature: for the gentleman in question had placed himself under the care of a most intelligent and persevering surgeon, and yet the attempts made at reduction were not successful, merely from the nature of the accident, and not from any fault in the means employed. In these cases the use of pulleys will be required, and the action of the muscles should be lessened by tartarized antimony.

COMPOUND DISLOCATION OF THE ASTRAGALUS.

In the first case of this accident which I had an opportunity of witnessing, the astragalus was thrown inwards and forwards upon the os naviculare; and when I afterwards saw the limb upon the table of the dissecting-room, it having been removed by amputation, I exclaimed, surely that limb might have been saved.

In the case, of which an account was sent me by Dr. Lynn, Case.
of Bury St. Edmunds, it will be seen that the discharge of the
astragalus, in a compound dislocation of the ankle-joint, did
not prevent the patient's recovery; for he says, "In five
weeks a portion of the astragalus separated, and another piece
a week afterwards, which, when joined, formed the ball of that
bone."

Mr. Tyre, of Gloucester, had also under his care a case of Case.
compound luxation of the astragalus, in which he cut out the
luxated bone, and the patient had a good recovery, with a tolerably
useful foot.

DISLOCATION OF THE OS CALCIS AND ASTRAGALUS.

The five anterior bones of the tarsus are sometimes dislocated
from the os calcis and astragalus. There is a joint placed trans-
versely between the os calcis and astragalus, and the os naviculare
and os cuboides; and this joint is sometimes, but rarely, luxated
by very heavy weights falling upon the foot, of which the following
is an example.

SIMPLE DISLOCATION.

A man working at the Southwark Bridge, had the misfor- Case.
tune to have a stone of great weight glide gradually on his
foot: he was almost immediately brought to Guy's Hospital,
and the following were the appearances of the limb. The os
calcis and the astragalus remained in their natural situations,
but the fore part of the foot was turned inwards upon the
bones. When examined by the students, the appearance was
so precisely like that of a *club foot*, that they could not at first
believe that it was not a natural defect of that kind: but upon the
assurance of the man, that previously to the accident his foot was
not distorted, an extension was made by fixing the leg and the
heel; the fore part of the foot was then drawn outwards, and
thus the reduction was effected. This person was discharged

from the hospital in five weeks, having the complete use of his foot.

DISLOCATION OF THE OS CUNEIFORME INTERNUM.

I have twice seen this bone dislocated: once in a gentleman who called upon me some weeks after the accident, and a second time in a case which occurred in Guy's Hospital. In both these instances the same appearances presented themselves. There was a great projection of the bone inwards, and some degree of elevation, from its being drawn up by the action of the tibialis anticus muscle; and it no longer remained in a direct line with the metatarsal bone of the great toe. In neither case was the bone reduced.

The subject of the first of these accidents walked with but little halting, and I believe would in time recover the use of the foot, as not to appear lame. The cause of the accident was a fall from a considerable height, by which the ligament was ruptured which connects this bone with the os cuneiforme medium, and with the naviculare.

The second case, which was in Guy's Hospital, my apprentice Mr. Babington, informed me, happened by the fall of a horse through which the foot was caught between the horse and the curb-stone.

The treatment of this injury will consist in confining the bone in its place by at first binding it with a roller dipped in spirits of wine and water, with which it must be constantly kept wet: when the inflammation is subdued, a leathern strap is to be buckled around the foot, to keep the bone in its place till the ligament be united.

The metatarsal bones I have never known luxated: their union with each other, and their irregular connexion with the tarsus, prevent it; luxation, therefore, must be a very rare occurrence.

DISLOCATION OF THE TOES FROM THE METATARSAL BONES.

This is a very uncommon accident: but I had a man under my

at Guy's Hospital, who had such a degree of lameness as to be unable to get his bread by his daily labour, owing to an injury sustained by falling from a considerable height, and alighting on the extremities of his toes. Upon examination of the bottom of the foot, a considerable projection was found at the roots of all the smaller toes, each of the extremities of the metatarsal bones being placed under the first phalanges of those toes. Several months had elapsed from the time of the accident; and at first, from the swelling of the foot, it was not detected.

No extension, at the time when I saw him, could answer any purpose; and the only mode of relief was to wear a piece of raw cork at the bottom of the inner part of the shoe, to prevent the pressure of the metatarsal bones upon the nerves and blood-vessel.

The toes are sometimes dislocated; but as the mode of their action will be the same as that of the fingers, I shall reserve this subject until I describe the dislocation of the fingers.

DISLOCATIONS OF THE LOWER JAW.

An articular cavity is formed behind the root of the zygomatic process of the temporal bone, which receives the condyloid process of the lower jaw at the time when the mouth is shut; and a prominence which is placed before this cavity receives the lower jaw when the teeth are advanced upon the upper; both the cavity and the prominence are covered with articular cartilage. The condyloid process of the jaw rests in the cavity with an intervening cartilage whilst the mouth is shut, but it advances upon the surface of the zygomatic process when the jaw is much opened, or the upper teeth are advanced. Between the condyloid process and the articular surfaces an inter-articular cartilage is placed, having a double concave surface, which allows of the free motion of the jaw, and of its advance upon the zygomatic articular tubercle; whilst the coronoid or anterior process of the jaw is received between the zygomatic arch and the surface of the temporal bone.

Structure of the articulation.

Inter-articular cartilage.

Ligaments.

A capsular ligament unites the condyloid process to the temporal cavity and to the prominence before it, and joins the passage from one bone to the other, the edge of the inter-articular cartilage; whilst a strong internal lateral ligament passes from the margin of the articular cavity to the inner surface of the body of the lower jaw.

Muscles.

The jaw is drawn upwards and downwards, backwards and forwards, and transversely. Its elevation is produced by the temporal, the masseter, and the pterygoideus internus; its depression by the platysma myoides, digastricus, mylohyoideus, geniohyoides, and geniohyoglossus. The jaw is drawn backwards by the temporal muscle, and by a part of the masseter; and when the hyoides is fixed by the digastricus, the geniohyoideus, and the hyoglossus, it is pulled forwards by a portion of the masseter by the combined action of the pterygoidei externi.

The lateral motions of the jaw are principally produced by contractions of the external pterygoid muscles, which in all actions pull the jaw from side to side, and give it, with the temporal muscles, its grinding action, in which these muscles are assisted by the oblique motion forwards, given to the jaw by the pterygoideus internus.

Luxations.

The lower jaw is subject to two species of dislocation: viz. complete and the partial. When the dislocation is complete the condyles of the jaw are advanced into the space between the zygomatic arch and the surface of the temporal bone; but if it is partial, one condyloid process only advances, and the other remains in the articular cavity of the temporal bone.

COMPLETE LUXATION OF THE JAW.**Complete luxation.**

This accident is indicated by the open state of the mouth, by the impossibility of closing it, either by the patient's effort or by pressure made upon the chin. The lower jaw may be in some degree approximated to the upper by muscular effort, but the lower teeth, if the mouth could be closed, would be in a line anterior to the upper. Some degree of depression of the

Symptoms.

also still be produced, but to an inconsiderable extent. Thus the appearance of the patient is that of a continued yawning. The cheeks are projected by the advance of the coronoid processes towards the buccinator muscle, and there is a depression just anterior to the meatus auditorius, from the absence of the coronoid process from its cavity. The saliva is not retained in the mouth, but dribbles over the chin; and a very considerable increase of this secretion follows, in consequence of the irritation of the parotid glands.

The pain accompanying the accident is severe, but I have never seen any dangerous effect produced by it: on the contrary, the mouth becomes nearly closed by time, and a considerable degree of motion of the jaw is recovered.

This accident may be caused by taking into the mouth too large a body: as I have known when two boys in play, struggling for an apple, one has forced it into his mouth and dislocated his jaw. Causes.

A blow upon the chin, when the mouth is widely opened, produces the same effect. Yawning very deeply is also a frequent cause of the accident.

A sudden spasmodic action of the muscles will also produce this dislocation when the mouth is opened; and it has often happened in attempts to extract the teeth, where the mouth has been opened widely. Mr. Fox, dentist, whose death we have to deplore as a loss to the human race, informed me that he was called to a lady who had a tooth which required to be extracted, and that in the attempt to do so, a sudden spasm dislocated the jaw.

In this accident, the jaw must be immediately restored to its position; and the mode of reduction I shall explain by the following case.

A madman, confined in one of the houses in Hoxton, during an attempt to give him some food, which the keeper was obliged to show him to receive, had his jaw dislocated. Mr. Weston, surgeon of Shoreditch, was sent for; who, finding the man very powerful and very unmanageable, preferred rather to send for some other surgeon, to consider with him the best mode of making the reduction. Case.

attempt at reduction. When I saw the man I thought that a surgeon must be as insane as the patient who would employ the usual means of reduction; and I therefore desired that the keepers would place the patient on a table upon his back, with a pillow under his head, and that he should be held by several persons. I ordered two table forks to be brought me, and wrapped a handkerchief around their points. Placing myself behind the patient's head, I carried the handles of the forks, into the mouth, on each side, behind the molares teeth; then directed them to be held, and placing my hand under the chin, I forcibly drew it to the upper jaw, and the bone was easily and quickly reduced.

Corks to be preferred.

Levers.

In the above mentioned case the handles of the forks were not used as levers, by lifting them; they only rested upon the jaw, which was used as a lever upon them, depressing the process as the jaw was elevated, and thus directing the bone backwards into its natural situation. But as wood is liable to injure the gums, it is better to substitute two corks, which are to be placed behind the molares teeth on each side of the mouth, and over these the chin is to be raised. They are equally effectual in reducing the bone, and are less likely to injure it, or to bruise the soft parts. It has been recommended in these cases, to use a piece of wood as a lever, by introducing it between the molares teeth, first on one side and then on the other, reducing one side first and then using the same means to the other. Mr. Fox, in the case before alluded to, thus succeeded: he placed a piece of wood, a foot long, upon the molar tooth on one side, and raising it at the part at which he held it, depressed the point at the jaw on that side, and reduced the jaw. He then performed the same operation on the other side, and thus replaced the bone. But the corks, the recumbent posture, and the elevation of the chin, constitute the mode which I prefer.

In reducing this dislocation, the surgeon generally wraps the handkerchief round his thumbs, placing them at the roots of the coronoid processes, and depressing the jaw, forces it backwards as well as downwards, when the bone suddenly slips into its place.

at this mode does not so easily succeed as the others, excepting recent dislocations. When the jaw has been once dislocated, is very liable to the same accident, and therefore a broad tape, with a hole cut in it to receive the chin, divided into four ends by splitting on one side some way down, is to be tied over the summit of the head and occiput, to confine the jaw until the separated parts have healed, by which the tendency to subsequent dislocation is diminished. Liable to recur.

PARTIAL DISLOCATION OF THE JAW.

In this case, the condyloid process advances under the zygomatic arch on one side only, producing an incapacity to close the mouth: it is not so widely opened as in the complete dislocation. It is easy to distinguish this accident, as the chin is thrown to the side opposite to the luxation, and the incisores teeth are not only advanced upon the upper jaw, but are no longer in a line with the axis of the face. The cause of this accident is a blow on the side of the face when the mouth is opened, and in one case it occurred from vomiting in sea sickness. In this example, the lady, Miss Belfour, daughter of the late Admiral Belfour, of Portsmouth, reduced her jaw by an oyster-knife, which she turned half round upon the side of the jaw between the teeth, and so returned to its place. Partial dislocation.

In this injury, the lever of wood reduces the bone most easily, but the cork may be used on one side, and the chin be elevated, as in those cases in which the dislocation is complete. Symptoms.

SUBLUXATION OF THE JAW.

As in the knee, the thigh-bone is sometimes thrown from its place from the meniscular cartilages, so the jaw appears occasionally to quit the articular cartilage of the temporal cavity, slipping before its place, and locking the jaw, with the mouth slightly opened. It generally happens, that this dislocation is quickly removed by manual efforts alone; but I have seen it continue for a length of time, and the motion of the jaw, and the power of closing Symptoms.

Cause.

the mouth, have still remained. This state of the jaw happens from extreme relaxation. The patient finds himself suddenly incapable of entirely closing the mouth; some pain is felt, and the mouth is least closed on that side on which the pain is felt.

Reduction.

Force for removing these appearances must be applied directly downwards, so as to separate the jaw from the temporal bone, and to give an opportunity for the cartilage to replace itself upon the rounded extremity of the condyloid process.

Relaxation of ligaments.

In extreme degrees of relaxation, a snapping is felt in the maxillary articulation just before the ear, with some pain, arising from the sudden relapse of the jaw into its socket, which the relaxation of the ligament had permitted it to quit, and to advance upon the zygomatic tubercle.

Young women are generally subject to this sensation, and the means which I have found most frequently and quickly tending to insure their recovery, have been ammonia and steel as medicines with the shower-bath, and the application of a blister before the ear, when the complaint has continued for a length of time.

DISLOCATIONS OF THE CLAVICLE.

Dislocations rare.

As the clavicle is the only medium by which the arm is articulated with the bones of the chest, it might be expected that its location would be extremely frequent; but this bone is so peculiarly and strongly articulated, both with the sternum and scapula, as to render its dislocation comparatively rare.

Articulation.

In other articulations we find a capsular ligament proceeding from the edges of the articulating surfaces and peculiar ligaments to give strength to the junction of the bones; but in the articulation of the clavicle, like that of the lower jaw and knee, we meet with an inter-articular cartilage, composing a part of the articulating apparatus.

JUNCTION OF THE STERNAL EXTREMITY OF THE CLAVICLE
WITH THE STERNUM.**Bones.**

The articulating surfaces, both of the sternum and clavicle,

part rounded, and in part depressed; and both are covered by articular cartilage similar to that of the other joints. A capsular ligament proceeds from the end of the clavicle to the edge of the articulating surfaces of the sternum, and it is strengthened by short ligaments, which pass directly from one bone to the other.

Cartilage.

Within the capsular ligament is situated the inter-articular cartilage, joined at the upper part of the joint to the clavicle, and to the capsular ligament; and, below, to the edge of the articular surface of the sternum, and to the capsular ligament; it is inclined towards the end of the clavicle with the capsular ligament, so that the clavicle rests upon its surface, and it is also interposed between the bone and the sternum. Of that portion of this cartilage which is inclined to the clavicle, only about one half is smooth, the lower of the motion of that bone, and this is its lower and anterior part. The residue of it adheres to the articular cartilage of the clavicle, forming a flat, rough surface; but on the side towards the sternum, the inter-articular cartilage forms a smooth concave surface, which allows of its free motion on that surface. The inter-articular cartilage is placed not perpendicularly, but obliquely; its upper end is inclined inwards, and its lower end outwards, towards the first rib. From the upper point of the clavicle proceeds an inter-clavicular ligament, which adheres to the capsular ligament, and slightly to the sternum; and traversing the upper and back part of the sternum, it is fixed in the extremity of the opposite clavicle, and unites very strongly one clavicle to the other.

Inter-clavicular ligament.

The clavicle is also joined to the first rib by a clavicular-costal, which is called, rhomboid ligament, which proceeds from the anterior edge of the sternal end of the clavicle to the cartilage of the first rib.

Clavicular-costal ligament.

The motion of the clavicle, as well as that of the sternum, forwards and backwards, is performed upon the smooth surface of the inter-articular cartilage, which is applied to the sternum; but the motion of the clavicle, upwards and downwards, is

Motion of the clavicle.

produced upon the portion of the smooth surface of the inter-articular cartilage, which is applied to the clavicle: and another advantage derived from this mode of articulation is, that it allows of the motion of the bone outwards and backwards to a considerable extent, without occasioning any weakness in the ligament: for, in this view, it may be considered that there are two ligaments; one from the clavicle to the cartilage, and one from the cartilage to the sternum, instead of one loose, long ligament from bone to bone.

DISLOCATIONS OF THE STERNAL EXTREMITY OF THE CLAVICLE.

These are of two kinds: viz., the dislocation *forwards*, the clavicle being then thrown upon the sternum; or *backwards*, when the end of the bone is placed behind the sternum.

DISLOCATION FORWARDS.

The circumstances by which this injury is known are, that upon looking at the upper part of the sternum, a rounded projection is seen; and when the fingers are carried upon the surface of the sternum upwards, this projection stops them. If the surgeon places himself behind the patient, puts his knees between the scapulæ, grasps the shoulders and draws them back, the projection on the sternum disappears; but directly when the shoulders advance, the projection upon the sternum is renewed. The clavicle may be readily traced with the finger into the projection on the sternum. If the shoulder be elevated, the projection descends; if it be drawn downwards, the dislocated extremity of the bone becomes elevated to the neck. The motions of the dislocated clavicle are painful, and the patient moves the shoulder with difficulty. The point of the injured shoulder is less distant from the central line of the sternum than usual. In a very thin person the nature of the accident can be at once ascertained, because the bone is but little covered; but in fat persons it is more difficult to detect. When the patient is at rest, very little pain or tenderness is felt from the accident. It sometimes happens that this dis-

location is incomplete, the anterior portion of the capsular ligament only being torn, and the bone slightly projecting; but generally all the ligaments are lacerated, and the bone, with its inter-articular cartilage, is thrown forward. Partial.

The cause of this injury is a fall upon the point of the shoulder, when the force pushes the clavicle inwards and forwards, and projects it on the sternum; but it also frequently happens from a fall upon the elbow at the time when it is separated from the side, by which the clavicle is forced violently inwards and forwards against the anterior part of the capsular ligament. Its cause.

With respect to the means of reduction, and the principle upon which the treatment is to be regulated, there is no difficulty in practising the one, or in understanding the other. The clavicle is easily returned to its place by pulling the shoulder backwards, because then it is drawn off the sternum, and its end falls upon the cavity which naturally received it; but if pressure in this position of the shoulder be not made upon the fore part of the bone, it will be found still liable to project in some degree. Reduction.

The principle, therefore, upon which the extension is made, is to draw the scapula as far from the side as is practicable without inconvenience, and supporting the arm, to prevent its weight from influencing the position of the bone. Principle.

The first of these objects is best effected by the use of the clavicle bandage, and by the application of two pads or cushions affixed to it, which are placed in the axillæ. These pads throw the head of the os humeri from the side, and carry the scapula, and the clavicle connected with it, outwards and backwards, and thus the clavicle is drawn into its natural articular cavity. The second intention is effected by putting the arm in a sling, which, through the medium of the os humeri and scapula, supports it, and prevents the clavicle from being drawn down by the weight of the arm. Mode of extension.

DISLOCATION BACKWARDS.

The dislocation of the extremity of the bone backwards I have Dislocation backwards.

never known to occur from violence, yet it might happen from excessive force, as from a blow upon the fore part of the bone, which should tear the capsular and clavicular costal ligament, and allow the bone to glide behind the sternum, occasioning compression of the œsophagus, and rendering deglutition difficult. The trachea would, from its elasticity, elude pressure and escape to the opposite side of the space by which this tube enters the thorax.

Cause.

The only cause of this dislocation that I have known, was produced by great deformity of the spine, by which the scapula advanced and sufficient space was not left for the clavicle between the scapula and sternum; in consequence of which the bone gradually glided back behind the sternum, and produced so much inconvenience by its pressure on the œsophagus, as to lead to a necessity for the removal of its sternal extremity.

This case is extremely creditable to the knowledge, skill, and dexterity of Mr. Davie, surgeon at Bungay, in Suffolk; few would have thought of the mode of relief—very few would have dared to perform the operation—and a still smaller number would have had sufficient knowledge for its accomplishment.

The following particulars I in part received in conversation with Mr. Davie, who fell a victim to his great professional zeal, and in part from Mr. Henschman Crowfoot, surgeon of Beccles. He had the kindness to go over to Dr. Camell, of Bungay, to learn from him some of the particulars, and there met with a person who gave him several others, and who knew the patient for some years after the operation.

Case.

Miss Loffly, of Metfield, Suffolk, had a great deformity, arising from a distorted spine, increased by an accident which displaced the sternal extremity of the left clavicle, and threw it behind the sternum. The progressive distortion of the spine gradually advanced the scapula, and occasioned the sternal end of the clavicle to project inwards, behind the sternum, so as to press upon the œsophagus, and occasion extreme difficulty in deglutition. Her deformity had become excessive and her emaciation extreme.

Mr. Davie conceived that he should be able to prevent the gradual destruction which the altered position of the clavicle threatened, by removing the sternal extremity of the bone; and the operation which he performed for this purpose was, according to all I can learn, as follows.

An incision was made of from two to three inches in extent on the sternal extremity of the clavicle, in a line with the axis of that bone; and its surrounding ligamentous connections, as far as he could then reach them, were divided with the saw of Scultetus (often called Hey's); he sawed through the end of the bone, one inch from its articular surface from the sternum, and fearful of doing unnecessary injury with the saw, he introduced a piece of well-beaten sole leather under the bone while he divided it. When the sawing was completed, he tried to detach the bone, but it still remained connected by its inter-clavicular ligament, and he was obliged to tear through that ligament by using the handle of the knife as an elevator, and after some time succeeded in removing the portion of bone which he had separated.

The wound healed without any untoward occurrence, and the patient was enabled to swallow, as the pressure of the clavicle upon the œsophagus was now removed.

She lived six years after the operation, and recovered considerably from her former emaciation. "Of what she ultimately died," says Mr. Crowfoot, "I have not learnt."

JUNCTION OF THE CLAVICLE WITH THE SCAPULA.

The clavicle joins with the scapula about three quarters of an inch behind the extremity of the acromion. The end of the clavicle is slightly convex, and covered by an articular cartilage; the scapula is depressed to receive it, and this surface is also covered by an articular cartilage. Strong ligamentous fibres pass directly from the clavicle to the scapula, and under these a capsular ligament is extended from the head of the socket of the scapula, to the extremity of the clavicle. The surface of junction is very small, the end of the clavicle not being longer than the end of the

Articulation.

Ligaments.**Internal coraco-clavicular.**

little finger of an adult and the cavity in the scapula which receives it is very superficial, being not larger than is required to receive upon its surface the end of the clavicle. But the junction of the two bones is effected by much stronger means, through the medium of the coracoid process of the scapula, which sends forth two ligaments to the clavicle. The first proceeds from the root of the coracoid process, and is fixed in a small tubercle of the clavicle on its under side, at the insertion of the subclavius muscle, and two inches from the extremity of the bone. This ligament has been called the conoid, from its form, but may be better named the internal coraco-clavicular. The use of this ligament is, to bind down the clavicle to the scapula, and to confine the motion of the clavicle forwards and upwards.

External coraco-clavicular.

The second ligament of this part is called trapezoid; it proceeds from the coracoid process, and passes on the under side of the clavicle to near its scapular end, into which it is fixed; I call it the external coraco-clavicular. This ligament is the chief cause which lessens the tendency to dislocation of the scapular end of the clavicle: for when its capsular ligament is divided, the scapula cannot be forced under the clavicle without lacerating this ligament, so great is its resistance. It allows of very free motion of the scapula backwards and upwards, but confines its motions forwards. The motions of this extremity of the clavicle are performed by the subclavius muscle, although other muscles also move this bone.

DISLOCATION OF THE SCAPULAR EXTREMITY OF THE CLAVICLE.

This accident is more frequent than the dislocation of the sternal extremity.

When this extremity of the bone is luxated, the signs by which the surgeon ascertains the nature of the injury are as follow.

Symptoms.

The shoulder on that side, when compared with the opposite, appears depressed, for the clavicle is formed to give support to the scapula, and that support is lost in consequence of the accident. The point of the shoulder approaches nearer to the

sternum; and if the distance of the two shoulders from that bone be measured, this inequality is directly detected; the clavicle being naturally the means of preserving the distance of the scapula from the side, to throw out the shoulders, and to render the motions of the arm extensive. But the easiest mode of detecting this accident is, to place the finger upon the spine of the scapula, and to trace this portion of bone forward to the acromion in which it ends; the finger is stopped by the projection of the clavicle, and so soon as the shoulders are drawn back, the point of the clavicle sinks into its place, but it reappears when the shoulders are let go. The point of the clavicle projects against the skin upon the superior part of the shoulder, and much pain is felt when it is pressed.

In this injury the capsular ligament is necessarily torn through, as well as the external ligament, from the coracoid process to the clavicle, or no dislocation of the sternal extremity could occur. The internal ligament, when the dislocation is complete, must be also lacerated; but I have seen the clavicle project but slightly on the acromion in some of these accidents, denoting that the latter ligament had not given way.

It is scarcely probable that the clavicle should be ever dislocated in any other direction than upwards. At least, I have never seen an instance of the clavicle gliding under the acromion; but I would not deny the possibility of such an accident.

This species of dislocation is caused by a fall upon the shoulders, through which the scapula is forced inwards towards the ribs, and the accident which produces it is excessively violent. It has been said, that the action of the trapezius muscle alone could produce this effect; but that is impossible, as this muscle would not influence both the ligaments of the coracoid process, which must be torn through to produce the dislocation. Cause.

In the treatment of this accident, I adopt the following plan: Reduction.
The assistant, standing behind the patient, puts his knee between the shoulders, and draws them backwards and upwards, when the clavicle sinks into its socket. A thick cushion is then placed in

each axilla, for three purposes: First, to keep the scapula from the side: Secondly, to raise the scapula: Thirdly, to defend the axillæ from being hurt by the bandages; on which last account a cushion is employed on each side. Then the clavicle bandage is applied, and its straps should be sufficiently broad to press upon the clavicle, the scapula, and the upper part of the os humeri, to keep the former down, the scapula inwards and backwards, (which is the chief object,) and the arm backwards and elevated. To secure these objects more effectually, the arm is to be suspended in a short sling, by which it is made to support the scapula in its proper situation.

At the conclusion of my lecture upon this subject I have always given this counsel to the pupils:—"You are not to expect that the parts, after the utmost care in the treatment, will, in dislocations of either end of the clavicle, be exactly adjusted; some projection, some slight deformity will remain: and it is necessary, from the first moment of the treatment, that this should be stated to the patient, as he may otherwise suspect that the fault has arisen from your ignorance or negligence. You may at the same time inform him, that a very good use of the limb will be recovered, although some deviation from the natural form of the parts may remain, in a slight projection on the sternum, or some elevation of the sternal extremity of the clavicle."

DISLOCATION OF THE CLAVICLE WITH FRACTURE OF THE ACROMION.

There is a preparation of this injury in the Museum at St. Thomas's Hospital, and the following account of the case was given me by Mr. Smith.

Case.

A man, aged sixty years, was admitted into King's Ward, St. Thomas's Hospital, October 19, 1814, having fallen from a tree two or three days before. The surgeon to whom he applied told him that nothing was injured; but he himself persisted in saying his shoulder was broken, and walked up from Maidstone to the hospital. On examination, his shoulder appeared fallen as if displaced; but a little attention shewed that this was not the case. What.

however, the accident was determined to be, I do not recollect ; but the following treatment was adopted. Cushions were put in the axillæ, and a stellate bandage applied, with another just above the elbow to bind it to the side, and the arm was put in a sling, which seemed to keep the parts in their proper position ; but the next morning the bandages were loose. Supposing that this effect was produced by restlessness, they were again applied, but continued slipping off, day after day, until a week from his admission, when a long splint, placed across the shoulders, was bound to them by rollers, and the parts resumed their natural situation ; but after a short time, they were also obliged to be removed on account of the extreme irritability of the patient. He was then ordered to lie in bed upon his back without any bandage, but the parts became again displaced. No other attempt at relief was made, and he died on the 7th of December following, of some pulmonary disease, after an illness of three weeks.

On examination of his body, the clavicle was found dislocated at its scapular extremity, and projected considerably over the spine of that bone. The acromion process, just where the clavicle is united with it, was broken off.

The splint across the shoulders seemed likely to have succeeded in keeping the parts in apposition, if the man's illness and impatience would have permitted him to continue to wear it.

STRUCTURE OF THE SHOULDER-JOINT.

The shoulder-joint is composed of two portions of bone ; the Shoulder-joint.
glenoid cavity of the scapula, and the head of the os humeri.

The glenoid cavity is similar in form to a longitudinal section Glenoid cavity.
of an egg, with its larger extremity downwards and outwards, and its smaller upwards and inwards ; the cavity is so superficial, that the head of the humerus rather rests upon its surface than is received into its hollow ; it is, however, slightly concave, and is covered by an articular cartilage, which is somewhat extended beyond the edge of the bony cavity.

The coracoid process of the scapula is situated at the upper Coracoid pro-
cess.

point of the glenoid cavity, and its basis extends from thence to the notch of the superior costa ; it rises and inclines inwards and forwards, terminating in a point, which is situated under the clavicle, one third the length of that bone from its junction with the spine of the scapula, and on the inner side of the head of the os humeri, under the pectoral muscle. It covers and protects the joint on its inner side.

Cervix scapulæ. The glenoid cavity is united to the body of the scapula by a narrow neck, which is called the cervix scapulæ ; and its narrowest part is opposite to the notch of the superior costa of the scapula.

Head of the humerus. The head of the humerus is divided into three portions. The first is an articular surface forming a small part of a sphere, which rests upon the glenoid cavity of the scapula, and is covered with an articular cartilage ; the second is a process called the larger tubercle, formed for the insertion of three muscles ; it is situated on the outer portion of the head of the bone, under the deltoid muscle ; and the third is a process called the lesser tubercle, which is situated on the inner side of the head of the bone towards the axilla ; and in the usual position of the arm, nearly in a line with the point of the coracoid process of the scapula.

Bicipital groove. Between these two processes is a groove, which lodges the tendon of the long head of the biceps muscle, and is termed the bicipital groove.

Cervix humeri. Immediately below the head of the humerus is situated that portion of the bone called the cervix humeri.

Capsular ligament. The capsular ligament of this joint surrounds the head of the bone, and is attached to the whole circumference of the edge of the glenoid cavity, excepting where the tendon of the biceps muscle passes under it ; and at that point it arises from a ligament which proceeds from the coracoid process to the edge of the glenoid cavity. The capsular ligament is also fixed to the two tubercles, and towards the axilla, to the neck of the humerus, just below its articular surface. This ligament is not of a uniform thickness ; but at those parts where the joint is not defended

from injury by the tendinous insertions of muscles, the capsular ligament itself is thickened, and is capable of sustaining great violence ; and this difference is remarkably shewn in that part of the ligament which is placed in the axilla, it being of a strong tendinous nature.

Four muscles are destined to move the os humeri, and to strengthen the capsular ligament. The first, the supra-spinatus, which arises from the fossa supra-spinata, covers the head of the bone, blends its tendon with the capsular ligament, and is inserted into the larger tubercle ; the second, the infra-spinatus muscle, which proceeds from the fossa infra-spinata, adheres to the back part of the capsular ligament, and is also fixed to the greater tubercle ; the third, the teres minor, which arises from the lower edge of the scapula, adheres to the back part of the capsular ligament, and is inserted into the greater tubercle, and into the cervix humeri ; the fourth, is the subscapularis muscle, which fills up the venter, or inner concave surface of the scapula ; it passes over the inner side of the head of the bone, and is fixed to the smaller tubercle, firmly adhering to the capsular ligament as it passes over its inferior and inner surface. It is between the subscapularis muscle, and the teres minor, that the capsular ligament is found of great strength, as there are no muscles inserted into that part to protect the joint from injury.

Muscles of protection to the joint.

The deltoid muscle, the coraco-brachialis, and the teres major, which are also muscles of this joint, are not united with the capsular ligament as the other muscles, being only destined for the motion, and not particularly for the projection of the shoulder-joint.

Muscles of motion to the joint.

The tendon of the long head of the biceps protects the upper part of the joint, where it otherwise would be weak ; for this tendon is situated between that of the supra-spinatus and subscapularis : it arises from the upper point of the edge of the glenoid cavity of the scapula, and passes over the head of the bone into the groove between the two tubercles and the portion of the capsular ligament. Reflected towards the articular cartilage

Tendon of the biceps.

of the os humeri it adheres to the surface of this tendon, so that the synovia is prevented from escaping.

Cause of the frequency of dislocation.

The shoulder-joint has a greater extent and variety of motion than any other joint in the body; and its dislocations are, consequently, more frequent than those of all the other joints in the body collectively: those of the ankle-joint being next in frequency.

DISLOCATIONS OF THE OS HUMERI.

Four kinds of dislocation.

This bone is liable to be thrown from the glenoid cavity of the scapula in four directions; three of these luxations are complete, and one is only partial.

Downwards and inwards.

The *first* is downwards and inwards; it is usually called the dislocation into the axilla, and in this accident the bone rests upon the inner side of the inferior costa of the scapula.

Forwards.

The *second* is forwards upon the pectoral muscle, when the head of the os humeri is placed below the middle of the clavicle, and on the sternal side of the coracoid process.

Backwards.

The *third* is the dislocation backwards, when the head of the bone can be both felt and distinctly seen, forming a protuberance on the back and outer part of the inferior costa of the scapula, and situated upon its dorsum.

Partial dislocations.

The *fourth* is only partial, when the anterior portion of the capsular ligament is torn through, and the head of the bone is found resting against the coracoid process of the scapula, on its outer side.

Of the dislocation upwards.

It has been supposed that a dislocation of the os humeri upwards might occur, but it is obvious that this could only happen under fracture of the acromion. It is an accident which I have never seen.

Dislocation in the axilla.

Of the dislocation in the axilla I have seen a multitude of instances; of that forwards on the inner side of the coracoid process several, although these are much less frequent than that in the axilla; of the dislocation backwards I have seen only two instances during the practice of my profession for thirty-eight



PLATE XV.

Dislocation of the os humeri forwards, under the clavicle, and behind the pectoral muscle.

a, Clavicle.

b, Scapula.

c, Acromion.

d, Glenoid cavity of the scapula, from which the os humeri had been thrown; and on the inner side of this cavity is seen the coracoid process.

e, The head of the os humeri, with the tendon of the biceps passing over it; the head of the bone under the middle of the clavicle, in the centre of the scapula, and on the inner side of the coronoid process.

f, Portions of the new ligament, which inclosed the head of the bone.



years. I do not believe in any change of place after dislocation, when the muscles have once contracted, (except from subsequent violence, which is very uncommon,) beyond that slight change which pressure, by producing absorption, will sometimes occasion.

The bone is generally at once thrown into the situation which it afterwards occupies: so that, excepting from circumstances of great violence, the nature and direction of the dislocation are not subsequently changed.

DISLOCATION IN THE AXILLA.

The usual signs in this dislocation are as follow: a hollow is produced below the acromion, by the displacement of the head of the humerus from the glenoid cavity, and the natural roundness of the shoulder is destroyed, because the deltoid muscle is flattened and dragged down with the depressed head of the bone. The arm is somewhat longer than the other, as the situation of the bone upon the inferior costa of the scapula is below the level of the glenoid cavity. The elbow is with difficulty made to touch the patient's side, from the pain produced in this effort by pressure of the head of the bone upon the nerves of the axilla; and upon this account it usually happens, that the patient himself supports his arm at the wrist or fore-arm with the other hand, to prevent its weight pressing upon these nerves. The head of the os humeri can be felt in the axilla, but only if the elbow be considerably removed from the side. I have several times seen surgeons deceived in these accidents, by thrusting the fingers into the axilla when the arm is close to the side, when they have directly said, "this is not a dislocation;" but upon raising the elbow, the head of the bone could be distinctly felt in the axilla; for that movement throws the head of the bone downwards and more into the axilla.

Signs of dislocation into the axilla.

The motion of the shoulder is in a great degree lost, more especially in the direction upwards and outwards, for the patient can no longer raise his arm by muscular effort, and even the

surgeon generally finds some difficulty in overcoming its fixed position; it is usual, therefore, as a first question in detecting dislocation, to ask the patient if he can raise his arm to his head, and if there be dislocation, the answer is invariably that he cannot. The power of rotation of the arm is also lost; but the motion of the limb forwards and backwards, as it hangs by the side, is still preserved. There is, however, great difference in respect to the motion of the limb, and this depends upon the age of the patient: in old people the relaxed state of the muscles will not only admit of motion, but allow the surgeon to carry the arm to the upper part of the head. On moving the limb, a slight crepitus will sometimes be felt from inflammatory effusion, and from the escape of synovia, but by the continuance of the motion this soon ceases; the crepitus, however, in these cases, is never so strong as that which a fracture produces. The central axis of the arm is changed, for the central line runs into the axilla.

In this accident numbness of the fingers frequently occurs from the pressure of the head of the bone upon a nerve or the nerves of the axillary plexus.

Circumstances
that render the
nature of the ac-
cident difficult to
be ascertained.

These are circumstances of the greatest moment: but it will be seen that the accident can be detected principally by the fall of the shoulder, by the presence of the head of the bone in the axilla, and by the loss of the natural motions of the joint. But a few hours make these appearances much less decisive, from the extravasation of blood, and from the excessive swelling which sometimes ensue; when, however, the effused blood has become absorbed, and the inflammation has subsided, the marks of the injury become again decisive. At this period it is that surgeons of the metropolis are usually consulted; and if we detect a dislocation which has been overlooked, it is our duty, in candour, to state to the patient, that the difficulty in the detection of the nature of the accident is exceedingly diminished by the cessation of inflammation, and the absence of tumefaction.

Circumstances
that render it
easy.

It may be also observed, that there is great difference in the facility with which the accident is discovered in thin persons of ad-

vanced age, and in those who are loaded with fat ; or who have, by constant exertion, rendered their muscles excessively large.

DISSECTION OF THE DISLOCATION INTO THE AXILLA.

I have dissected two cases of recent dislocation downwards. A sailor fell from the yard-arm on the ship's deck, injured his skull, and dislocated the arm into the axilla. He was brought into St. Thomas's Hospital in a dying state, and expired immediately after he was put into his bed. On the following day I obtained permission to examine his shoulder, which I removed from the body for the purpose of obtaining a more minute examination ; and the following were the appearances which I found. On removing the integuments, a quantity of extravasated blood presented itself in the cellular membrane, lying immediately under the skin, and in that which covers the axillary plexus of nerves, as well as in the interstices of the muscles, extending as far as the cervix of the humerus, below the insertion of the subscapularis muscle.

The axillary artery, and plexus of nerves, were thrown out of their course by the dislocated head of the bone, which was pushed backwards upon the subscapularis muscle. The deltoid muscle was sunk with the head of the bone. The supra and infra-spinatus were stretched over the glenoid cavity and inferior costa of the scapula. The teres major and minor had undergone but little change of position ; but the latter near its insertion, was surrounded by extravasated blood. The coraco-brachialis was uninjured. In a space between the axillary plexus and coraco-brachialis, the dislocated head of the bone, covered by its smooth articular cartilage and by a thin layer of cellular membrane, appeared. The capsular ligament was torn on the whole length of the inner side of the glenoid cavity, which would have admitted a much larger body than the head of the os humeri through the opening. The tendon of the subscapularis muscle, which covers the ligament, was also extensively torn. The opening of the ligament, by which the tendon of the long head of the biceps passed,

Appearances
upon the dissec-
tion of the limb.

was rendered larger by laceration, but the tendon itself was not torn. The head of the os humeri was thrown on the inferior costa of the scapula, between it and the ribs; and the axis of its new situation was about an inch and a half below that of the glenoid cavity, from which it had been thrown.

The second case which I had an opportunity of examining, was one in which the dislocation had existed five weeks, and in which very violent attempts had been made to reduce the dislocated bone, but without success. The subject of the accident was a woman fifty years of age. All the appearances were distinctly marked; the deltoid muscle being flattened, and the acromion pointed; the head of the bone could also be distinctly felt in the axilla; the skin had been abraded during the attempts at reduction, and the woman apparently died from the violence used in the extension. Upon exposing the muscles, the pectoralis major was found to have been slightly lacerated, and blood effused; the latissimus dorsi and teres major were not injured; the supraspinatus was lacerated in several places; the infra-spinatus and teres minor were torn, but not to the same extent as the former muscle. Some of the fibres of the deltoid muscle, and a few of those of the coraco-brachialis, had been torn; but none of the muscles had suffered so much injury as the supra-spinatus. The biceps was not injured.

Having ascertained the injury which the muscles had sustained in the extension, and, in some degree, the resistance which they opposed to it, I proceeded to examine the joint.

The capsular ligament had given way in the axilla, between the teres minor and subscapularis muscles; the tendon of the subscapularis was torn through at its insertion into the lesser tubercle of the os humeri; the head of the bone rested upon the axillary plexus of nerves and the artery. Having determined these points by dissection, I next endeavoured to reduce the bone, but finding the resistance too great to be overcome by my own efforts, I became very anxious to ascertain its origin. I therefore divided one muscle after another, cutting through the coraco-brachialis,

teres major and minor, and infra-spinatus muscles; yet still the opposition to my efforts remained, and with but little apparent change. I then conceived that the deltoid must be the chief cause of my failure, and by elevating the arm, I relaxed this muscle; but still could not reduce the dislocation. I next divided the deltoid muscle, and then found the supra-spinatus muscle my great opponent, until I drew the arm directly upwards, when the head of the bone glided into the glenoid cavity. The deltoid and supra-spinatus muscles, are those which most powerfully resist reduction in this accident.

It appears from these dissections, that the best direction in which the arm may be extended for reduction, is at a right angle with the body, or directly horizontally, rather than obliquely downwards: as the deltoid, supra and infra-spinati muscles, are, in this position of the limb, thrown into a relaxed state, and these muscles are, as I have explained, the principal sources of the resistance. The biceps is to be relaxed by slightly bending the elbow. The arm may be extended directly outwards, in the line between the pectoralis major on the outer side, and the latissimus dorsi and teres major on the inner; but if there be any deviation from this line, it will be better rather to advance the arm, to lessen the power of the pectoralis major.

This dissection explains the reason why the arm is sometimes easily reduced soon after the dislocation, by raising it suddenly above the horizontal line, and placing the fingers under the head of the bone, so as to raise it towards the glenoid cavity, which, as every tyro knows, will sometimes prove effectual; because, in this position, the muscles of opposition are relaxed so as to oppose no resistance to reduction.

DISSECTION OF A DISLOCATION WHICH HAD BEEN LONG UNREDUCED.

The head of the bone is found altered in its form; the surface towards the scapula being flattened, a complete capsular ligament covers the head of the os humeri. The glenoid cavity is completely filled by ligamentous matter, infused by a slow inflammatory process; in this ligamentous matter are suspended small

Dissection of an old dislocation.

portions of bone, which appear to be of new formation, as no portion of the scapula or humerus is broken; a new cavity is formed for the head of the os humeri on the inferior costa of the scapula, but this is glenoid, like that from which the os humeri had escaped.

Causes of dislocation into the axilla.

The common causes of dislocation of the os humeri into the axilla are, falls upon the hand while the arm is raised above an horizontal line, by which the head of the bone is thrown downwards; also a fall upon the elbow, when the arm is raised from the side: but the most frequent cause is a fall directly upon the shoulder on some uneven surface, by which the head of the bone is driven downwards, whilst the muscles are but ill prepared to resist the shock.

Frequency of its recurrence.

When the arm has been once dislocated, if great care be not taken of the limb after its reduction, it is extremely liable to a recurrence of the accident. I remember, particularly, a carpenter, who used to be a frequent visitor at Guy's Hospital for several years, for the purpose of having his shoulder reduced. Slighter causes than that which originally produced it, will renew the dislocation; I have known it to recur from the act of throwing up the sash of a window. During my apprenticeship at St. Thomas's Hospital, in going through the wards early one morning, I was directed to see a man who had just dislocated his shoulder, which he had frequently done before, as he was lying in bed; and upon inquiring how it had happened, the man replied, that it occurred merely in the effort of rubbing his eyes and stretching himself upon waking; but this disposition to the recurrence of dislocation may be prevented, by directing that the arm be kept fixed close to the side, and the shoulder rather elevated by a pad in the axilla, for three weeks after its reduction; during which time the ruptured tendon of the subscapularis, and the capsular ligament will be united: a process which motion greatly impedes, if not wholly prevents.

REDUCTION OF THE DISLOCATION IN THE AXILLA.

Means employed for reduction.

Various have been the means suggested for the reduction of the

head of the humerus, when dislocated downwards into the axilla ; but, under the different circumstances attending this accident, different means must be employed: the first, and that which I usually adopt in my private practice in all recent cases, is

By the Heel in the Axilla:

And the best mode of its application is as follows. The patient should be placed in the recumbent posture, upon a table or sofa, near to the edge of which he is to be brought ; the surgeon then binds a wet roller round the arm immediately above the elbow, upon which he ties a handkerchief ; then with one foot resting upon the floor, he separates the patient's elbow from his side, and places the heel of his other foot in the axilla, receiving the head of the os humeri upon it, whilst he is himself in the half sitting posture by the patient's side. He then draws the arm by means of the handkerchief, steadily for three or four minutes, when, under common circumstances, the head of the bone is easily replaced ; but if more force be required, the handkerchief may be changed for a long towel, by which several persons may pull, the heel still remaining in the axilla. I generally bend the fore-arm nearly at right angles with the os humeri, because it relaxes the biceps, and consequently diminishes its resistance. I have, in many cases, extended from the wrist, by tying the handkerchief just above the hand, but more force is required in this than in the former mode, although it has this advantage, that the bandage is less liable to slip. In recent cases it very rarely happens that this mode of extension fails, and it is so easily applied in every situation, that I have recommended all our young men to employ it in the first instance, when called to this accident.

Heel in the
axilla.

Second Mode.

But in those cases in which the muscles are of very considerable strength, and the dislocation having existed for several days, the muscles have become permanently contracted, so that the limb is

Second mode

Application of
the bandage.

strongly fixed in its new situation, more force is required, and the following means should be employed. The patient must be placed upon a chair, and the scapula fixed by means of a bandage, which allows the arm to pass through it; that which we use at our hospital is a girth buckled on the top of the acromion, so as to raise the bandage high in the axilla, and thus enable it more completely to fix the scapula, which is the *principal object* to be attended to, as otherwise all efforts will be inefficient. When I first saw the mode of reduction practised thirty-eight years ago, a round towel was used instead of this bandage, which was placed in the axilla, and crossed the chest; but it appeared to me that by this means the lower angle of the scapula alone was fixed, and that the glenoid cavity was drawn with the arm when extension was made: I directed, therefore, that the towel should be tied over the opposite shoulder with a handkerchief, so that it should be raised in the axilla on the injured side, and thus embrace a larger surface of the scapula; but still I found the scapula drawn from the side with the arm, and therefore had the bandage made as described. A wet roller is next to be bound around the upper arm just above the elbow, from which situation it cannot slip; and upon this a very strong worsted tape is to be fastened, in a manner to be described when speaking of the reduction of dislocated fingers. The arm should then be raised at right angles with the body, and if there be much difficulty in the reduction, it should be elevated above the horizontal line, more completely to relax the deltoid and supra-spinatus muscles. Two persons should then draw from the bandage affixed to the arm, and two from the scapular bandage, with a steady, equal, and combined force; jerking should be entirely avoided, and every aim at quick reduction should be discountenanced: *slowly and steadily* should be the word of command from the surgeon; who, after the extension has been kept up for a few minutes, should place his knee in the axilla, resting his foot on the chair upon which the patient sits; he should then raise his knee by extending his foot, and placing his right hand upon the acromion, push it downwards and inwards, when the head of the

bone will usually slip into its natural position. Whilst the extension is proceeding, I have seen a gentle rotatory motion of the arm diminish opposition of the muscles, and the bone suddenly slip into its place.

But when a limb has remained a considerable length of time dislocated; when the muscles are so powerfully contracted that the force of men cannot be so steadily exerted as to reduce the limb, after several attempts, the minds and bodies of the assistants becoming fatigued, and their efforts violent and unequal, then we employ the third mode of reduction—

By means of the Pulleys.

And here let it be understood, that they are not adopted with a view of employing greater force, for that might be obtained by the aid of more persons; but they are introduced to enable the surgeon to employ the force gradually and equally; to avoid jerks and unequal extension, which, in protracted cases, the efforts of men are sure to produce. If therefore I saw a surgeon, as soon as the pulleys were fixed, draw them violently, and endeavour suddenly to reduce the limb, I should not hesitate at once to say, "That gentleman is ignorant of the principle upon which his mechanical power is employed, and has still this part of his profession to learn." For the application of the pulley the patient is to be seated between two staples, which are screwed into the wainscot on each side of him; the bandages are then applied, precisely as in the former mode, in which the extension is performed by men, and the force is applied in the same direction: the surgeon should first draw the pulley, as the class of people usually summoned to his assistance, being ignorant of the principle upon which it is employed, would use too great violence; he should draw gently and steadily, until the patient begins to complain of pain, and then cease, keeping up the degree of extension, and conversing with the patient to direct his mind to other objects. In two or three minutes, more force should be applied, and continued until pain be again complained of, when the surgeon should again cease

Pulleys.

Application of
the pulley.

to increase the force ; and thus he should proceed for a quarter of an hour, at intervals slightly rotating the limb. He should, when he has applied all the extension he thinks right, give the string of the pulley to an assistant, desiring the existing degree of extension to be supported ; then, putting his knee in the axilla, and resting his foot upon the chair, he should gently raise and push back the head of the bone towards the glenoid cavity, when the bone will pass into its socket ; this takes place generally without the snap which is heard when other means are employed, yet both the surgeon and the patient are aware of some motion of the head of the bone at the time*. If the pulleys be thus employed the extension will be conducted infinitely more steadily and effectually than when performed by men. In my hospital practice I ordered the patient to be bled, and put into a warm bath at the temperature of 100 to 110; and I give him a grain of tartarized antimony every ten minutes until he becomes faint ; then I order him to be removed from the bath, to be wrapped in a blanket, and immediately placed upon a chair for extension, before his muscles have had time to recover,—which expedient lessens the necessity of employing very considerable force. Mr. Henry Cline, surgeon to St. Thomas's Hospital, son to my most excellent master, and who would have made an excellent practical surgeon if the hand of death had not prematurely deprived the world of his useful talents, was in the habit of directing his patients to support a weight for a length of time before the extension was begun, with a view of fatiguing the muscles, and lessening their power of resistance. In apartments where it is not convenient to place the pulleys in the walls, I have fixed them in the floor, on each side of the patient, who must under these circumstances, sit upon the floor. When the reduction has been effected, a small cushion should be placed in the axilla and fixed there by a stellate bandage, to prevent the head of the

Efficacy in producing a tendency to syncope.

Constitutional means of assisting reduction.

Means of preventing the head of the bone slipping from its situation immediately after the reduction.

* One of our pupils, a Mr. Bartlett of Ipswich, has invented a small spring by means of which the strings are attached to the pulley, and which can suddenly detach them while the knee is in the axilla. This instrument may sometimes be useful.

bone from again slipping out of its situation, which the excessive relaxation of the muscles would readily permit: but the cushion should not be so large as to separate the arm from the side. The sling is to be also worn to support the arm.

There is still a fourth mode of reducing the dislocation into the axilla, which is applicable to recent dislocations, to delicate females, and to very old, relaxed and emaciated persons, viz.:

By the Knee in the Axilla.

The patient is seated upon a low chair, the surgeon placing himself by him, separates the dislocated arm from the side sufficiently to admit his knee into the axilla, and resting his foot upon the side of the chair, he places one hand upon the os humeri, just above the condyles, and the other upon the acromion scapulæ; he then pulls down the arm over the knee, and in this manner reduces the dislocation. Even in persons of powerful muscles, I have known this mode succeed, when the patient remained in the state of intoxication in which he was found when the accident happened.

Fourth mode of reduction.

The Ambe has been recommended for the reduction of dislocations in the axilla; and this instrument was, in the last century, improved by the addition of a screw for the purpose of rendering its extension more gradual. It may succeed very well in recent cases, and in those persons whose muscles are not very powerful, but when a continued extension must of necessity be used to reduce the bone, as its fixed point of action is upon the ribs of the patient, it produces too much injury to the side, is too painful to be borne long, and is, therefore, an instrument which cannot be recommended for general use.

The use of the Ambe.

Mr. Kirby, surgeon in Dublin, has lately advised an ingenious mode of applying force in dislocations of the shoulder: the scapula being fixed and the bandage applied to the arm, the patient sits upon a mattress which is laid upon the floor, and the assistants, to whose management the extension and counter-extension are assigned, place themselves at his side, sitting opposite to each other,

and disposing their legs so that the soles of their feet are opposed to each other, behind and before the patient. If occasion should require a greater force than the power of two men, another assistant or more may be placed at the backs of the first two, sitting close up to them with their faces turned towards the patient; the extension is now made, with the arm raised nearly to a right angle with the body, and in the direction forwards or backwards, as the circumstances of the case may require. The force should be maintained until it is perceived that the head of the bone (which can be easily felt, and should be pressed upon during the operation) has moved from its new situation; and when the head of the bone is found to change its position, the assistants should slowly diminish their force, while the surgeon directs it towards the glenoid cavity, by pressing the elbow to the side of the patient and slightly raising it.

Slight force necessary for reductions after repeated dislocation.

When a person has frequently dislocated his shoulder, a very slight effort is sufficient to restore the limb to its place; and I know a gentleman in the country who has frequently returned the dislocated head of the humerus into its situation, by walking up to a gate, reaching over as far as he could, and then holding by one of its lower bars, the upper bar of the gate being pressed firmly into the axilla; still retaining his hold, he suffers his body to sink on the other side of the gate, and the head of the bone is thus pushed into the glenoid cavity; this mode of reduction is the same in principle as that of the heel in the axilla, which, as I have already mentioned, in three fourths of recent dislocations, is the best for effecting the reduction.

DISLOCATION FORWARDS, BEHIND THE PECTORAL MUSCLE, AND BELOW THE MIDDLE OF THE CLAVICLE.

Symptoms.

This species of dislocation is much more distinctly marked than the former. The acromion is more pointed, and the hollow below it, from the depression of the deltoid muscle, is much more considerable. The head of the os humeri can be readily and distinctly felt, and even seen, in thin persons, just below the clavicle; and

when the arm is rotated from the elbow, the protuberance may be seen to obey the motions of the arm.

Situation of the head of the humerus.

The coracoid process of the scapula is placed on the outer side of the head of the bone, so that the latter is situated between the scapula and the sternum, and is covered by the pectoralis major muscle. The arm is somewhat shortened, and the elbow is thrown more from the side, and farther back, than in dislocation into the axilla. The axis of the limb is much altered, being thrown inwards towards the middle of the clavicle.

The pain attending this accident is slighter than when the head of the os humeri is thrown into the axilla, because the nerves of the axillary plexus are less compressed; but the motions of the joint are much more materially affected; the head of the bone becoming fixed by the coracoid process and neck of the scapula on the outside, and by the clavicle above: while the muscles of the scapula, as the supra and infra spinati, and teres minor, being put upon the stretch, confine all its motions inwards and backwards. If, therefore, the arm be attempted to be brought forwards, the head of the bone strikes against the clavicle: if outwards, from the side, the coracoid process stops it: its motion backwards, however, is confined not by bone, but by the resistance of muscles. But the strongest diagnostic marks of this dislocation are these; the head of the bone is below the clavicle: the elbow is separated from the side, and thrown backwards; and the rotation of the arm gives motion to the head of the bone under the clavicle.

The degree of pain in this accident.

Diagnostic marks.

DISSECTION OF THE DISLOCATION FORWARDS.

The head of the os humeri is, in this accident, thrown on the inner side of the neck of the scapula, between it and the second and third ribs. I have had no opportunity of dissecting a recent accident of this kind; but in the Museum at St. Thomas's Hospital there is a beautiful specimen of one in a limb which had been long dislocated and which was removed from the shoulder of a patient by Mr. Green, and dissected by Mr. Key, who gave me the following account of the appearances:—The head of the

Appearances on
dissection.

bone was thrown on the neck and part of the venter of the scapula near the edge of the glenoid cavity, and immediately under the notch of the superior costa : nothing intervened between the head of the humerus and scapula, the subscapularis being partly raised from its attachment to the venter. The head was situated on the inner side of the coracoid process, and immediately under the edge of the clavicle, without having the slightest connexion with the ribs ; indeed, this must have been prevented by the situation of the subscapularis and serratus magnus muscles between the thorax and humerus. The tendons of all the muscles attached to the tubercles of the humerus were perfect, and are shewn in the preparation. The tendon of the biceps was not torn ; and it adhered to the capsular ligament. The glenoid cavity was completely filled up by ligamentous structure ; still, however, preserving its general form and character. The tendons of the supraspinatus, and teres minor muscles, adhered by numerous bands to the ligamentous structure occupying the glenoid cavity ; and to prevent the effects of friction between the tendons in the glenoid cavity in the motions of the arm, a sesamoid bone had been formed in the substance of the tendons. The newly-formed socket reached from the edge of the glenoid cavity to about one-third across the venter. A complete lip was formed around the new cavity, and the surface was irregularly covered with cartilage. The head had undergone considerable change of form, the cartilage being in many places absorbed. A complete new capsular ligament had been formed.

The pectoralis minor is not mentioned in this dissection ; but from the natural situation of the coracoid process, into which this muscle is inserted, it must have passed over the head of the os humeri, as did the pectoralis major.

Causes of dislocation.

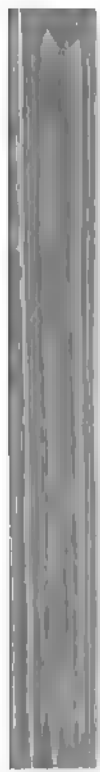
The usual causes of this dislocation are, either a fall upon the elbow, or a violent blow upon the shoulder, as in the last-described dislocation. If it be a blow upon the elbow which has produced the accident, it must have been inflicted at a time when the elbow was thrown behind the central line of the body ; and when it

elder received the blow, the head of the bone must have been en forwards and inwards.

REDUCTION OF THE DISLOCATION FORWARDS.

In this, as in the former case, we can usually succeed in effect-reduction by placing the foot in the axilla, and by extending arm in the same manner; excepting that, in this dislocation, foot is required to be brought more forward to press on the l of the bone, and the arm should be drawn obliquely downwards, and a little backwards; but in those cases in which some have elapsed before reduction has been attempted, continued nsion will be necessary; and, to employ it steadily and effect-y, the pulleys should be used.

The same bandage is required as in the dislocation in the axilla, ther the power used be applied through the medium of pulleys, directly by men. The arm should be bent to relax the biceps cle; but the principal circumstance to be considered is, the ction in which the bone is to be drawn, and the best direction ightly downwards; for if it be drawn horizontally, the head he os humeri is pulled against the coracoid process of the ulla, and a difficulty created which may be avoided. The inciple upon which the pulley is employed, and the manner in ch the extension is supported, are the same as in the dislocation the axilla; but the direction is different, the arm being drawn quely downwards and backwards. The extension must be t up longer than in the dislocation downwards, as the resist-e is greater; but as soon as the bone is felt to move from its ation, the surgeon should give the strings of the pulley to an stant, and putting his knee or heel against the head of the bone he fore part of the shoulder, should push it back towards the noid cavity: but this step is not of the smallest utility until the e has been drawn below the level of the coracoid process: and ilst the surgeon is thus pressing the head of the bone back-rds, he should pull the arm forwards from the elbow. This is plan which I have found by far the most effectual in reducing : dislocation forwards.



The unfrequent
occurrence of
this accident.

and when the elbow is rotated, this protuberance roll
dislocated head of the bone may be easily grasped
fingers, and distinctly felt resting below the spine of
the motions of the arm are impaired, but not to the as
in either of the other states of luxation.

Two cases of this accident have occurred in Guy'
thirty-eight years; the first during my apprenticeship
pened during the anatomical lecture at St. Thoma
The surgery-man came to the theatre, and announc
was a dislocation of the shoulder at Guy's Hospital
Cline went over with the students to see the accide
Mr. Foster, under whose care the patient was admitte
ture of the accident was at once obvious, from the proj
head of the bone on the dorsum scapulæ. The ba
applied in the same manner as if the head of the humeri
in the axilla, and the extension was made in the same
in that accident. During the progress of the adjust
apparatus, some conversation took place between M
Mr. Foster, as to what variation in direction there shou
to the bone, if the first attempt should not succeed
than five minutes, the bone slipped into the glenoid c
loud snap.

The second case, which occurred several years after
reduced by the dressers, under the same treatment.

joint, and the posterior half of the glenoid cavity is perceptible, from the advance of the head of the bone ; the axis of the arm is thrown inwards and forwards ; the inferior motions of the limb are still capable of being performed ; but its elevation is prevented by the head of the humerus striking against the coracoid process ; there is an evident protuberance formed by the head of the bone in its new situation, which is felt readily to roll when the arm is rotated.

Mr. Brown, aged fifty years, was thrown from his chaise on his shoulder, and upon examination after the accident, the roundness of the shoulder was lost, and there was a hollow under the acromion ; the head of the bone projected forwards and inwards against the coracoid process ; the arm could be raised from the side if brought forwards, but with difficulty raised directly upwards. By extension of the shoulders backwards, I at last brought the head of the bone to the glenoid cavity, but it directly again slipped forwards when extension ceased. This dislocation differs from that forwards under the pectoral muscle, the head of the os humeri being still on the scapular side of the coracoid process, while in the complete dislocation forwards, it is thrown on its sternal side.

This accident happens from the same causes which produce the dislocation forwards. The anterior part of the ligament is torn, and the head of the bone has an opportunity of escaping forwards to the coracoid process.

The mode for its reduction will be the same as that for the dislocation forwards, but it is necessary to draw the shoulders backwards to bring the head of the bone to the glenoid cavity ; and immediately when the reduction is completed, the shoulders should be bound back by the clavicle-bandage, or the bone will immediately again slip forwards against the coracoid process.

Dislocations of the shoulder are sometimes complicated with fracture of the head of the os humeri ; and we have a preparation in the Museum at St. Thomas's Hospital, in which the greater tubercle at the head of the bone had been broken off, and the os humeri thrown into the axilla. This complication of accident does

Means of reduction, and of preventing the recurrence of the dislocation.

Dislocation of the shoulder complicated with fracture.

not add to the difficulty of reduction, but, on the contrary, rather facilitates the return of the bone, as the insertion of the principal opponent muscles, the supra and infra spinati, is removed; but it increases the difficulty of retaining the bone within the glenoid cavity after the reduction is completed.

FRACTURE OF THE NECK OF THE OS HUMERI, WITH THE DISLOCATION FORWARDS, UNDER THE PECTORAL MUSCLE.

Case.

Mr. John Blackburn fell from his horse, many years ago, at Enfield, and dislocated his shoulder forwards. Mr. Lucas, sen., surgeon of Guy's Hospital, was sent for; who said, after he had made considerable extension, that the bone was reduced. Five weeks afterwards, Mr. B. came to London, and shewed me his shoulder, when, the appearances of dislocation still remaining, I advised a further extension, to which he would not consent. I had frequent opportunities of seeing him afterwards, but the shoulder exhibited the same appearances of dislocation. He had, however, the power of using the hand and arm in all directions excepting upwards, but could not raise his arm to form a rectangle with his body; and he suffered but little pain or inconvenience.

In June 1824, he died; and as he had always promised me the dissection of his shoulder if I survived him, I removed it in the presence of Mr. Arnott, surgeon of Greenwich Hospital, examined it with great care, and have the bones preserved. The deltoid, teres major, and coraco-brachialis muscles, did not appear to me to be altered; the supra-spinatus was lessened, as was the teres minor, which had lost considerably of its natural colour: the infra-spinatus was stretched; the subscapularis, diminished and rounded by the projection of the head of the os humeri, adhered to its cartilaginous surface. The capsular ligament was torn under the subscapularis muscle, but every other part was entire. The head of the os humeri had been thrown forwards on the inner side of the coracoid process, and had united by bone to the scapula; but its cartilage remained under the tendon of the subscapularis

The neck of the os humeri was broken through, and had been covered by a granular ligamentous substance; but the parts were kept together only by the ligament of the joint, and a new and very useful joint had been formed. The outer edge of the glenoid cavity remained: the surface of the glenoid cavity was granulated and ligamentous. The greater tubercle of the os humeri was exceedingly increased, and the tendon of the biceps passed through the bone. The tubercles were separated with the body of the bone, and not with its head.

This, then, was a case of fracture of the cervix humeri within the capsular ligament, terminating in a ligamentous union.

COMPOUND DISLOCATION OF THE OS HUMERI.

An injury of excessive violence will sometimes occasion the head of the bone to be forced through the integuments, in the dislocation forwards. It happened in the practice of Messrs. Saumarez and Dixon, of Newington; and for the following detail of its circumstances I am indebted to Mr. Dixon.

“My dear Sir:—I feel pleasure in answering the queries you have put. The accident happened to Robert Price, fifty-five years of age, who, on returning in a state of intoxication from the Borough, fell down upon his shoulder. Upon examination, I found that the head of the bone, having passed through the integuments at the axilla, lay exposed upon the anterior part of the chest, and situated over the pectoral muscle on the right side. The reduction of the dislocation was easy, being performed without the necessity of raising him from the state of stupor and insensibility in which he was lying, by the usual method of extension and counter-extension, taking care only to guide the bone into the glenoid cavity; he was then put to bed and an evaporating lotion applied. On the following morning considerable pain and tension came on; he was bled, and purged freely; a large poultice was applied over the joint, and anodynes were given to lessen the pain and procure

sleep; leeches were frequently applied in the neighbourhood of the joint for the first ten days or fortnight, after which, a copious discharge of pus issued from the wound in the axilla. The constitution now felt the effects of so important an injury; he became irritable, restless, and lost flesh. Healthy pus was discharged freely from the joint for ten or twelve weeks, when it somewhat abated. A succession of small abscesses, situated in the cellular membrane surrounding the joint, were exceedingly troublesome for several months: some of them formed extensive sinuses, requiring to be freely dilated. The discharge of pus from the joint was kept up nearly twelve months, when it finally ceased, leaving the joint ankylosed, and the wound closed. He was quite recovered fourteen months after the accident, when he called on me, and felt gratified, by shewing how freely he could make use of the fore-arm, and handle his pen for all the purposes of business."

Treatment.

Such a case will require an immediate reduction, by the means which I have described for the dislocation of the os humeri forwards; and, in general, the greater the violence done to the injured limb, the more easy is the reduction, from the diminution of the constitutional powers which so great a shock produces. When the bone is replaced, lint dipped in blood is to be applied to the wound; or if the wound be large, a suture should be employed, and then the lint applied: adhesive plaster should be used to support approximation, and the limb should be kept close to the side by means of a roller passed round the body, including the arm, and thus preventing the least motion of the head of the bone: by these means the suppurative inflammation may be prevented, and the cure may proceed without protracted suffering, or any danger to the patient's life.

PARTIAL DISLOCATION OF THE OS HUMERI FORWARDS.

Case.

Mr. Bachelor, of Southville, aged thirty-six, fell from a chair on the 12th of November, and, as he supposes, pitched on his

oulder. On rising, he could not move his right arm for ten minutes, when some sudden spasm gave him the power of moving underhand. Inflammation succeeded; the shoulder became much swollen, with pain down the arm to the fingers, and particularly in the direction of the cubital nerve. On looking at the arm the same evening, he found that the os humeri appeared to be added.

It is two months since the injury, and the hand is now benumbed. There is much pain at the insertion of the biceps into the fore-arm, so that he has been often obliged to rise twice during the night to put his hand in warm water.

The appearances are, a projection of the acromion, and a hollow beneath it; the head of the os humeri rests against and under the acromion process, and the scapular end of the clavicle is opposite the middle of the head of the bone. The biceps muscle was relaxed and lessened; the coracoid process of the scapula was not difficultly felt above, and to the inner side of the head of the os humeri.

The principle of treatment in these cases is, to oppose the pectoralis major by a clavicle-bandage, with a broad strap over the back of the os humeri, and by bringing the elbow forward, to keep the head of the os humeri back.

DISLOCATION OF THE OS HUMERI BACKWARDS.

Mr. J. S. Perry, surgeon of St. Bartholomew's Hospital, had the following Case. I have the pleasure to send me the following case, for which I am much indebted to him. Our large hospitals in London should be made as conducive as possible to the advantage of the public, by a liberal reciprocal communication.

A man fell from the roof of a coach, and struck the point of his right shoulder against a projecting stone. He suffered little pain at the time of the accident; but finding himself incapable of using his arm, he came immediately to the hospital.

Upon examination, I found that the head of the humerus was

and the head of the bone falls with it into the axilla ; the shoulder in this case falls ; there is a hollow below the acromion from the sinking of the deltoid muscle, and the head of the os humeri can be felt in the axilla.

Case.

A young lady was thrown from a gig, by the fall of the horse, in the Strand ; and being carried to her house, a surgeon in the neighbourhood was sent for, who told her the shoulder was dislocated ; by extension all the appearances of dislocation were removed, and he bound up the arm. On the following morning he requested me to see the case, as the arm he said was again dislocated. On examination I found the head of the bone in the axilla, and the shoulder so fallen and flattened as to give the accident many of the characters of dislocation ; however, by elevating the shoulder, in raising the arm at the elbow, and the head of the bone from the axilla, it was immediately replaced ; but when I gave up this support the limb instantly sank again. I then rotated the elbow, and pressing the coracoid process of the scapula with my fingers, by grasping the top of the shoulder directly felt a *crepita*. Having satisfactorily ascertained the nature of the accident, I placed a thick cushion in the axilla, and drawing the shoulder into its natural position, secured it by the application of a clavicle-bandage, and in seven weeks it became united without deformity.

The degree of deformity produced by this accident, depends upon the extent of laceration of a ligament, which passes from the under part of the spine of the scapula to the glenoid cavity, and which is not generally described in anatomical books. If this be torn, the glenoid cavity and the head of the os humeri fall deeply into the axilla ; but the displacement is much less if this remain whole.

Diagnostic marks.

The diagnostic marks of this accident are three : *first*, the facility with which the parts are replaced ; *secondly*, the immediate fall of the head of the bone into the axilla, when the extension is removed ; and, *thirdly*, the crepitus which is felt at the extremity of the coracoid process of the scapula, when the arm is rotated. The best method of discovering the crepitus is, for the surgeon's

hand to be placed on the top of the shoulder, and the point of the fore-finger to be rested on the coracoid process; the arm being then rotated, the crepitus is directly perceived, because the coracoid process being attached to the glenoid cavity, and being broken off with it, although itself uninjured, the crepitus is communicated through the medium of that process.

The treatment of this fracture consists in attention to two principles. The first is to carry the head of the os humeri outwards; and the second, to raise the glenoid cavity and arm. The former is effected by a thick cushion placed in the axilla, which presses the head of the bone and glenoid cavity outwards, and this may be confined by the clavicle-bandage; the latter is produced by placing the arm in a short sling, and then the raised head of the os humeri supports the glenoid cavity and cervix scapulæ, and keeps it steadily in its place until union is produced. The time required for recovery from these accidents in the adult is, from ten to twelve weeks; in the very young all the motions of the limb are restored in a shorter period, but it is a long time before the limb recovers its strength.

Treatment of
this accident.

FRACTURE OF THE NECK OF THE OS HUMERI.

The humerus is sometimes broken just below its tubercles, through its cervix. I have seen this accident happen both in old and in young persons, but it rarely occurs in middle age. In the young it happens at the junction of the epiphysis, where the cartilage is situated; and in the old it arises from the greater softness of this part of the bone. In this fracture the head of the bone remains in its place, but the body of the humerus sinks into the axilla, where its extremity can be felt; and it draws down the deltoid muscle, so as to lessen the roundness of the shoulder. Just as I was writing this account, a child was brought into Guy's Hospital with this accident, on which I made the following notes.

Age.

Symptoms.

Its age was ten years. The symptoms of the injury were inability of moving the elbow from the side, or of supporting the

arm, unless by the aid of the other hand, without great pain. The tension which succeeded filled up the hollow which was at first produced by the fall of the deltoid muscle. When the head of the bone was fixed, the fractured extremity of the body of the humerus could be tilted under the deltoid muscle so as to be felt, and even seen, by raising the arm at the elbow. Crepitus could be perceived, not by rotating the arm, but by raising the bone and pushing it outwards. The cause of the fracture was a fall upon the shoulder into a saw-pit of the depth of eight feet.

It is in old persons that this accident is most liable to be mistaken for dislocation: for in them the flexibility of the joint is much diminished by it, and the changes of position of the bone are less easily produced.

Diagnostic symptoms.

The best diagnostic marks are the following. Embrace the head of the os humeri with the fingers and fix it, then rotate the arm at the elbow, and it will be found that the head of the bone does not obey the rotatory motion, as it is separated from the body of the humerus by the fracture; which is, in this case, external to the capsular ligament. The reduced bone in these instances unites in from three to six weeks, according to the age of the patient.

Treatment.

The treatment consists in applying a roller from the elbow to the shoulder-joint, in placing a splint on the inner and on the outer side of the arm, and in confining these by means of a roller. A cushion is then to be placed in the axilla, to throw out the head of the bone, and the arm is to be gently supported by a sling; for if it be much raised, the bone will overlap, and the union will be deformed.

STRUCTURE OF THE ELBOW-JOINT.

Bones.

This joint is composed of three bones—the lower extremity of the humerus, the upper part of the ulna, and the head of the radius. The extremity of the os humeri is expanded, and presents two lateral eminences, which are called its condyles, the internal of which is the most prominent; between these condyles the

PLATE XVI

Fig 1

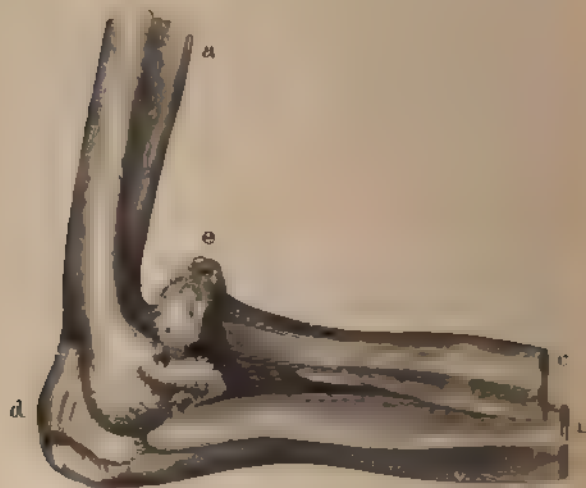


Fig 2

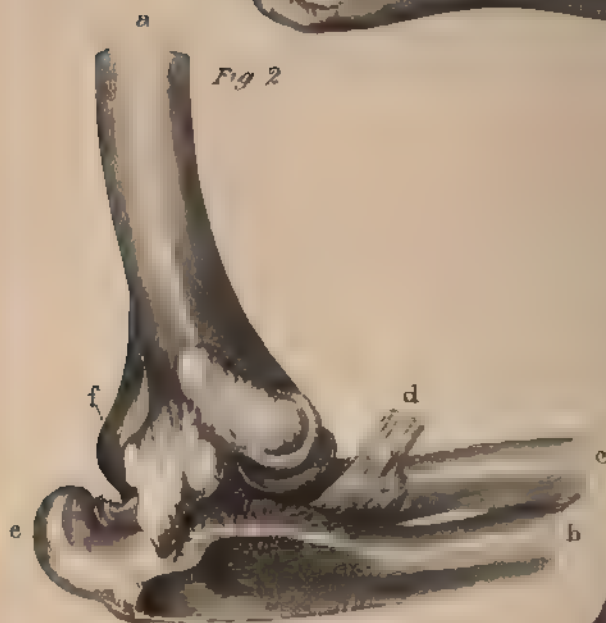


Fig 3.

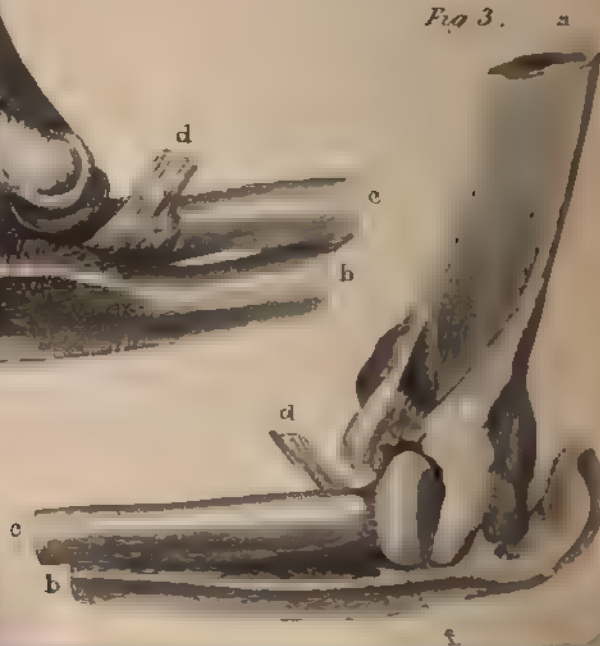


PLATE XVI.

Fig. 1. A dislocation of the ulna backwards.

- a*, Os humeri.
- b*, Ulna.
- c*, Radius.
- d*, Insertion of the biceps flexor cubiti into the tubercle of the radius.
- e*, Olecranon thrown behind the os humeri.
- f*, Some appearance of injury to the internal condyle of the os humeri.

Fig. 2. Opposite view of the same preparation.

- a*, Os humeri.
- b*, Ulna.
- c*, Radius.
- d*, Insertion of the biceps into the tubercle of the radius.
- e*, Olecranon thrown backwards.
- f*, Head of the radius, which, by its pressure against the external condyle of the os humeri, has produced a socket there for itself.

Fig. 3. *Dislocation of the Radius.* The bone is thrown upon the external condyle, and upon the coronoid process of the ulna.

- a*, Os humeri.
- b*, Ulna.
- c*, Radius.
- d*, Olecranon.
- e*, Head of the radius. The coronary ligament and a part of the interosseous ligament is torn through, and the head of the bone is thrown upon the coronoid process of the ulna, and external condyle of the os humeri.

articular surface for the ulna is situated, which is in the form of a pulley; and above it, both anteriorly and posteriorly, is situated a deep cavity, with a thin partition intervening. On the lower extremity of the external condyle is placed an articular surface, on which the head of the radius is received. The upper extremity of the ulna forms two processes, with an articulatory surface between them, which is adapted to the pulley-like articular surface of the os humeri: both these surfaces of the ulna and humerus are covered with cartilage. The superior and posterior process of the ulna is called the olecranon, which forms the point of the elbow, and into which the triceps muscle is inserted. The anterior and smaller process is called the coronoid, which gives insertion to the brachialis internus. When the arm is extended, the point of the olecranon is received into the posterior cavity, between the condyles of the humerus; and when it is flexed, the coronoid process passes into the anterior hollow; so that these cavities are formed for the purpose of allowing free extension and flexion of the arm. The head of the radius is rounded, and rests upon the broad articular surface of the humerus, upon which it bends; on its inner side it is received into an articular cavity on the radial side of the coronoid process of the ulna, upon which the radius rolls; and thus all the motions of the fore-arm are performed. Immediately below its head the radius becomes smaller, and this part is called its cervix: at the distance of an inch below its head is seated a process which is called its tubercle.

The ligaments which bind these bones together are the *capsular*, Ligaments. which is united with the condyles, and with the portion of bone Capsular. above the cavities of the os humeri; it passes over the extremity of the humerus, and is united behind to the olecranon, and to the coronoid process on the fore part of the ulna; it is also connected to the coronary ligament of the radius. This ligament posteriorly is loose and slender, but on the fore part it is of considerable strength.

The *coronary* ligament surrounds the head of the radius: it is Coronary. connected above with the capsular ligament, and below with the

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It is a thin lamina of sufficient length to allow it to extend beyond the end of the bone: it is also attached to the fore end of the coronoid process of the tibia. At its internal extremity it is thus firmly united the radius with the ulna, and is the origin of the former.

— The internal osseous—the protonotical.
— The internal osseous—the protonotical.
— The internal osseous—the protonotical.

...of the lateral ligament, which
...of the humerus, and to the cor-
...these ligaments are to the joint

... *due*. Hence passes from the com-
... the *radius*, that below its tubercle; and
... the division of the *radius*.

... the inner side of the coronal
... this inner process is broad
... which prevents it

1. The first step is to insert the capsule into the mouth. The capsule is inserted into the mouth and the fore-arm is raised. The capsule is then inserted into the mouth and the fore-arm is raised. The capsule is then inserted into the mouth and the fore-arm is raised.

whilst it extends the arm, it supports the capsular ligament. The *biceps* muscle does not protect the ulnar joint, but has great influence in preventing a dislocation of the radius forwards, in the extended state of the arm. It is not connected with the capsular ligament, as the other muscles are; but arising tendinous from the glenoid cavity, and coracoid process of the scapula, it becomes fleshy in its middle, and again forms a tendon at the elbow-joint, which is fixed into the tubercles of the radius. This muscle bends the fore-arm, rotates the radius outwards, that is, supines the hand, and compresses the capsular ligament opposite the head of the radius.

DISLOCATIONS OF THE ELBOW-JOINT.

There are five species of dislocation of this joint :—

First, both bones are dislocated backwards.

Secondly, both are dislocated laterally.

Thirdly, the ulna is dislocated separately from the radius.

Fourthly, the radius alone is dislocated forwards : and

Fifthly, the radius is dislocated backwards.

DISLOCATION OF BOTH BONES BACKWARDS.

Symptoms.

This dislocation is strongly marked by the great change which is produced in the form of the joint, and by its partial loss of motion. The shape of the elbow is altered, as there is considerable projection posteriorly, formed by the ulna and radius, above the natural situation of the olecranon. On each side of the olecranon appears a hollow. A considerable hard swelling is felt at the fore part of the joint, immediately behind the tendon of the *biceps* muscle, formed by the extremity of the humerus; the hand and fore-arm are supine, and cannot be rendered entirely prone. The flexion of the joint is also in a great degree lost.

DISSECTION OF THIS DISLOCATION.

I have had an opportunity of dissecting a compound dislocation of this joint, where the radius and ulna were thrown backwards, Dissection of the dislocation backwards.

and it is preserved in the Museum at St. Thomas's Hospital. The coronoid process of the ulna was thrown into the posterior fossa of the os humeri, and the olecranon projected at the back part of the elbow, above its natural situation, an inch and a half, the radius was placed behind the external condyle of the os humeri, and the humerus was thrown forwards on the anterior part of the fore-arm, where it formed a large projection. The capsular ligament was torn through, anteriorly, to a great extent. The coronary ligament remained entire. The biceps muscle was slightly put upon the stretch, by the radius receding; but the brachialis internus was excessively stretched by the altered position of the coronoid process of the ulna.

Cause of the
accident.

This accident usually happens in a fall when a person puts out his hand to save himself, the arm not being perfectly extended, so that the bones are forced back behind the axis of the os humeri, by pressure of the whole weight of the body upon them.

This dislocation is easily reduced by the following means. The patient is made to sit down upon a chair, and the surgeon, placing his knee on the inner side of the elbow-joint, in the bend of the arm, and taking hold of the patient's wrist, bends the arm; at the same time he presses on the radius and ulna with his knee, so as to separate them from the os humeri, and thus the coronoid process is thrown from the posterior fossa of the humerus: whilst this pressure is supported by the knee, the arm is to be forcibly, but slowly, bent, and the reduction is soon effected. It may be also accomplished by placing the arm around the post of a bedstead, and by forcibly bending it while it is thus confined. I have also reduced the limb by making the patient, whilst placed upon an elbow-chair, put his arm through the opening in its back, and then, having bent the arm, the body and limb being thus well fixed, the reduction was easily effected.

This dislocation is sometimes undiscovered at first, in consequence of the great tumefaction which immediately succeeds the injury; but this circumstance does not prevent the reduction, even at the period of several weeks after the accident: for I have

known it then effected by bending the limb over the knee, even without the application of very great force.

As soon as the reduction has been accomplished, the arm should be bandaged in the bent position; evaporating lotions should be applied, and the limb be supported in a sling; the fore arm should be bent at rather less than a right angle with the upper arm. A splint may be placed in the sling for the better support of the limb. After-treatment.

LATERAL DISLOCATION OF THE ELBOW.

In this case the ulna, instead of being thrown into the posterior fossa of the os humeri, has its coronoid process situated on the back part of the external condyle of the humerus. The projection of the ulna backwards is greater in this than in the former dislocation, and the radius forms a protuberance behind and on the outer side of the os humeri, so as to produce a hollow above it; the rotation of the head of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the internal condyle of the os humeri, so as to produce an apparent hollow above it: the rotation of the head of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the internal condyle of the os humeri, but it still projects posteriorly, as in the external dislocation; and then the head of the radius is placed in the posterior fossa of the humerus. The external condyle of the os humeri in this case projects very much outwards. I have never had an opportunity of dissecting this injury. Nature of the accident.

The manner in which the lateral dislocation is produced is the same as in that directly backwards, but the direction of the fall is varied; it is also caused by the wheel of a carriage passing over the arm whilst it is placed upon uneven ground. The reduction in each may be effected as in the former dislocation, by bending the arm over the knee, even without particularly attending to the direction of it inwards or outwards; for as soon as the radius Causes of this accident.

as not only the brachialis muscle will act in resistance, but the radius resting against the external condyle, will push the os humeri backwards upon the ulna when the arm is bent.

DISLOCATION OF THE RADIUS FORWARDS.

This bone is sometimes separated from the ulna at their junction at the coronoid process, and its head is thrown into the hollow above the external condyle of the os humeri, and upon the coronoid process of the ulna. Symptoms of this accident.

I have seen six examples of this accident: its symptoms are as follow: the fore arm is slightly bent, but cannot be brought to a right angle with the upper, nor can it be completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri, and produces so sudden a stop to its motion, as at once to convince the surgeon that one bone strikes against the other. The hand is placed in a prone position, but neither its pronation nor supination can be completely performed, although its pronation be nearly complete. If the thumb be carried into the fore and upper part of the elbow-joint, the head of the radius may be there felt; and if rotation of the hand be attempted, the bone will be perceived to roll; this last circumstance, and the sudden stop to the bending of the arm, are the best diagnostic marks of the injury.

In the dissection of this case, the head of the radius is found resting in the hollow above the external condyle of the os humeri; the ulna is in its natural situation. The coronary ligament of the radius, the oblique ligament, and the fore part of the capsular, as well as a portion of the interosseous ligament, are torn through; the laceration of the latter ligament allows the separation of the two bones; the biceps muscle is shortened: and those who have not seen an example of this injury, will do well to consult the bones of the arm in the position I have now described them. Dissection.

The cause of this accident is a fall upon the hand when the arm is extended; the radius receiving the weight of the body, is forced Cause of this accident.

neck of the radius, by a thin ligament of sufficient length to allow of rotation of the head of the bone; it is also attached to the fore and back part of the coronoid process of the ulna, at its lateral articular surface, and thus firmly unites the radius with the ulna, yet allows of the rotation of the former.

Brachio-cubital. There are four peculiar ligaments:—First, the *brachio-cubital*, or internal lateral ligament, which passes from the internal condyle of the os humeri into the coronoid process of the ulna.

Brachio-radial. Secondly, the *brachio-radial*, or external lateral ligament, which is fixed to the external condyle of the humerus, and to the coronary ligament of the radius; these ligaments give to the joint a strong lateral support.

Oblique. The third ligament is the *oblique*, which passes from the coronoid process of the ulna to the radius, just below its tubercle; and it is this ligament which limits the rotation of the radius.

A ligament also reaches from the inner side of the coronoid process to the olecranon; and when this latter process is broken off, it is this ligament, in some instances, which prevents its extensive separation.

Muscles. The muscles of the joint are, first, the *brachialis internus*, which passes over the anterior part of the condyles and capsular ligament to which it is attached: it is inserted, in an oblique direction, into the coronoid process, and into the body of the ulna just below it. The use of this muscle is to bend the fore-arm, and give support to the elbow-joint, by strengthening the capsular ligament. The next muscle is the *triceps*, which arises by one of its heads from the inferior costa of the scapula, and by its two others from the os humeri: it descends to the capsular ligament, to the loose portion of which it adheres, and is inserted into the point of the olecranon. This muscle extends the arm, and draws up and supports the capsular ligament. Thirdly, the *anconæus*, which arises from the back part of the external condyle of the humerus, adheres to the capsular ligament, and is inserted to the extent of an inch and a half into the body of the ulna, directly below the olecranon. The course of this muscle is oblique; and

whilst it extends the arm, it supports the capsular ligament. The *biceps* muscle does not protect the ulnar joint, but has great influence in preventing a dislocation of the radius forwards, in the extended state of the arm. It is not connected with the capsular ligament, as the other muscles are ; but arising tendinous from the glenoid cavity, and coracoid process of the scapula, it becomes fleshy in its middle, and again forms a tendon at the elbow-joint, which is fixed into the tubercles of the radius. This muscle bends the fore-arm, rotates the radius outwards, that is, supines the hand, and compresses the capsular ligament opposite the head of the radius.

DISLOCATIONS OF THE ELBOW-JOINT.

There are five species of dislocation of this joint :—

First, both bones are dislocated backwards.

Secondly, both are dislocated laterally.

Thirdly, the ulna is dislocated separately from the radius.

Fourthly, the radius alone is dislocated forwards : and

Fifthly, the radius is dislocated backwards.

DISLOCATION OF BOTH BONES BACKWARDS.

Symptoms.

This dislocation is strongly marked by the great change which is produced in the form of the joint, and by its partial loss of motion. The shape of the elbow is altered, as there is considerable projection posteriorly, formed by the ulna and radius, above the natural situation of the olecranon. On each side of the olecranon appears a hollow. A considerable hard swelling is felt at the fore part of the joint, immediately behind the tendon of the *biceps* muscle, formed by the extremity of the humerus ; the hand and fore-arm are supine, and cannot be rendered entirely prone. The flexion of the joint is also in a great degree lost.

DISSECTION OF THIS DISLOCATION.

I have had an opportunity of dissecting a compound dislocation of this joint, where the radius and ulna were thrown backwards, Dissection of the dislocation backwards.

and it is preserved in the Museum at St. Thomas's Hospital. The coronoid process of the ulna was thrown into the posterior fossa of the os humeri, and the olecranon projected at the back of the elbow, above its natural situation, an inch and a half. A radius was placed behind the external condyle of the os humeri, and the humerus was thrown forwards on the anterior part of the fore-arm, where it formed a large projection. The capsular ligament was torn through, anteriorly, to a great extent. The ulnar artery remained entire. The biceps muscle was stretched, but put upon the stretch, by the radius receding; but the brachialis internus was excessively stretched by the altered position of the coronoid process of the ulna.

Cause of the accident.

This accident usually happens in a fall when a person puts his hand to save himself, the arm not being perfectly extended, so that the bones are forced back behind the axis of the os humeri by pressure of the whole weight of the body upon them.

This dislocation is easily reduced by the following means. The patient is made to sit down upon a chair, and the surgeon, placing his knee on the inner side of the elbow-joint, in the bend of the arm, and taking hold of the patient's wrist, bends the arm; at the same time he presses on the radius and ulna with his knee, to separate them from the os humeri, and thus the coronoid process is thrown from the posterior fossa of the humerus: under this pressure is supported by the knee, the arm is to be forced, but slowly, bent, and the reduction is soon effected. It may also be accomplished by placing the arm around the post of a bedstead, and by forcibly bending it while it is thus confined. I have reduced the limb by making the patient, whilst placed upon an elbow-chair, put his arm through the opening in its back, then, having bent the arm, the body and limb being thus fixed, the reduction was easily effected.

This dislocation is sometimes undiscovered at first, in consequence of the great tumefaction which immediately succeeds the injury; but this circumstance does not prevent the reduction, even at the period of several weeks after the accident: for I

shown it then effected by bending the limb over the knee, even without the application of very great force.

As soon as the reduction has been accomplished, the arm should be bandaged in the bent position; evaporating lotions should be applied, and the limb be supported in a sling; the fore arm should be bent at rather less than a right angle with the upper arm. A lint may be placed in the sling for the better support of the limb.

After-treatment.

LATERAL DISLOCATION OF THE ELBOW.

In this case the ulna, instead of being thrown into the posterior fossa of the os humeri, has its coronoid process situated on the back part of the external condyle of the humerus. The projection of the ulna backwards is greater in this than in the former dislocation, and the radius forms a protuberance behind and on the outer side of the os humeri, so as to produce a hollow above; the rotation of the head of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the internal condyle of the os humeri, so as to produce an apparent hollow above it: the rotation of the head of the radius is distinctly felt by rolling the hand. Sometimes the ulna is thrown upon the external condyle of the os humeri, but it still projects posteriorly, in the external dislocation; and then the head of the radius is placed in the posterior fossa of the humerus. The external condyle of the os humeri in this case projects very much outwards. We have never had an opportunity of dissecting this injury.

Nature of the accident.

The manner in which the lateral dislocation is produced is the same as in that directly backwards, but the direction of the fall is varied; it is also caused by the wheel of a carriage passing over the arm whilst it is placed upon uneven ground. The reduction may be effected as in the former dislocation, by bending the arm over the knee, even without particularly attending to the direction of it inwards or outwards; for as soon as the radius

Causes of this accident.

and ulna are separated from the os humeri by the pressure of the knee, the muscles give them a proper direction for reduction.

DISLOCATION OF THE ULNA BACKWARDS.

Symptoms of this accident.

The ulna is sometimes thrown back upon the os humeri without being followed by the radius. The appearance of the limb is then much deformed by the contortion inwards of the fore-arm and hand. The olecranon projects, and can be felt behind the os humeri. Extension of the arm is impracticable, but by a force which will reduce the dislocation; and it cannot be bent to more than a right angle. It is an accident somewhat difficult to detect; but its distinguishing marks are the projection of the ulna, and the twist of the fore-arm inwards.

Dissection.

We have an excellent specimen of this accident in the Museum at St. Thomas's Hospital. It had existed to a great length of time without reduction: the coronoid process of the ulna was thrown into the superior fossa of the humerus; the olecranon is seen projecting behind the os humeri; the radius resting upon the external condyle, and had formed a small socket for its head, in which it was able to roll. The coronary and oblique ligaments had been torn through, and also a small part of the interosseous ligament; the lower extremity of the internal condyle of the humerus seems to have had an oblique fracture in it; but I doubt whether it had been broken, or only altered in form, on account of the unnatural position of the ulna: if it had been broken it was reunited. The triceps was thrown backwards, and the brachialis internus muscle was stretched under the extremity of the humerus. The accident arises from a severe blow on the lower extremity of the ulna, by which it is pushed suddenly upwards and backwards.

Cause.

Mode of reduction.

This dislocation is more easily reduced than that of both bones; and the best method is to bend the arm over the knee, and to draw the fore-arm downwards; the reduction will then be easy.

not only the brachialis muscle will act in resistance, but the biceps resting against the external condyle, will push the os humeri backwards upon the ulna when the arm is bent.

DISLOCATION OF THE RADIUS FORWARDS.

This bone is sometimes separated from the ulna at their junction above the coronoid process, and its head is thrown into the hollow above the external condyle of the os humeri, and upon the coronoid process of the ulna. Symptoms of this accident.

I have seen six examples of this accident: its symptoms are as follows: the fore arm is slightly bent, but cannot be brought to a right angle with the upper, nor can it be completely extended. When it is suddenly bent, the head of the radius strikes against the fore part of the os humeri, and produces so sudden a stop to motion, as at once to convince the surgeon that one bone strikes against the other. The hand is placed in a prone position, neither its pronation nor supination can be completely performed, although its pronation be nearly complete. If the thumb be carried into the fore and upper part of the elbow-joint, the head of the radius may be there felt; and if rotation of the thumb be attempted, the bone will be perceived to roll; this last circumstance, and the sudden stop to the bending of the arm, are the best diagnostic marks of the injury.

In the dissection of this case, the head of the radius is found lying in the hollow above the external condyle of the os humeri; the ulna is in its natural situation. The coronary ligament of the radius, the oblique ligament, and the fore part of the capsular, as well as a portion of the interosseous ligament, are torn through; the laceration of the latter ligament allows the separation of the two bones; the biceps muscle is shortened: and those who have seen an example of this injury, will do well to consult the position of the arm in the position I have now described them. Dissection.

The cause of this accident is a fall upon the hand when the arm is extended; the radius receiving the weight of the body, is forced Cause of this accident.

up by the side of the ulna, and thrown over the condyle, and upon the coronoid process of the ulna.

Cases.

The first case I saw of this accident was in a woman, who was a patient of Mr. Cline's, in St. Thomas's Hospital, whilst I was an apprentice to him. The most varied attempts which his strong judgment could direct were made to reduce the bone, but they proved ineffectual; and the woman was discharged from the hospital with the dislocation unreduced.

The second case was in a lad to whom I was called by Mr. Bal-manno, of Bishopsgate-street; and although I made attempts, by continuing and varying the extension in every direction for an hour and a quarter, I could not succeed in effecting the reduction.

The third case was that of a hair dresser, who having been intoxicated in the evening came to my house on the following morning with his radius dislocated: during the time of examination the patient became faint, and at last fell upon the floor in a state of syncope; this I thought afforded me a most favourable opportunity for replacing the bone; and whilst he was still upon the floor I rested his olecranon upon my foot, so as to prevent the ulna from receding, and then extended the fore arm; and under these favorable circumstances, the radius returned to its natural situation.

The fourth case was that of a gentleman in Old Broad-street, to whom I was called by Mr. Gordon, of Oxford-court, in the city; and the manner in which we succeeded in the reduction was as follows:—We placed our patient upon a sofa, and bent his arm over the back of it; then making extension from the hand without including the ulna, the os humeri being fixed by the sofa, the radius in a few minutes slipped into its place.

The fifth case was that from which was made the preparation preserved in our collection at St. Thomas's Hospital. That preparation was one morning lying on my chimney-piece, when a gentleman of high character at the bar called upon me: who said, "What have you here?" And when I mentioned the

nature of the injury—"Well, that is very curious," said he; "for I have myself been the subject of this accident." He then exposed his arm, and shewed me a dislocation of the radius: it had happened many years before; and he told me that numerous and most violent attempts had been made to reduce it without success.

The observations here stated upon this subject I have usually given in my lectures, carefully explaining the difficulty in restoring the bone to its situation. Once, on an occasion of this kind, Mr. Williams, one of the most intelligent of my pupils, said to me, "I have known the radius reduced in these accidents by extension from the hand only." From a consideration of what he said, and from an experiment on the dead body, placing the radius in the situation in which it was thrown by this accident, I was convinced that the mode of extension mentioned by Mr. Williams, was the best; as, from the connection of the hand with the radius, that bone alone is acted upon; and the ulna being excluded from the force applied, the radius sustains the whole extension. It is also right in making the extension to render the hand supine, as this position draws the head of the radius from the upper part of the coronoid process of the ulna, upon which it would otherwise be directed; and then to draw the fore arm, by pulling the hand, and by fixing the os humeri.

DISLOCATION OF THE RADIUS BACKWARDS.

This is an accident which I have never seen in the living person; but in the winter of 1821, a man was brought for dissection into the theatre of St. Thomas's Hospital, in whom was found this dislocation, which had never been reduced. The head of the radius was thrown behind the external condyle of the os humeri, and rather to the outer side of the lower extremity of that bone. Mr. Sylvester, from Gloucester, a very intelligent student, had the kindness to make me a drawing of the parts as they were dissected. When the arm was extended, the head of the radius could be seen as well as felt behind the external condyle of the os humeri. On dis-

Appearance
of this accident.

secting the ligaments, the coronary ligament was found to be torn through at its fore part, and the oblique also had given way. The capsular ligament was partially torn, and the head of the radius would have receded much more, had it not been supported by the fascia which extends over the muscles of the fore arm.

Of the causes of this accident I know nothing, never having seen it in the living subject.

Mode of reduction.

As to its reduction, it will be easily effected by bending the arm; but to secure the bone from subsequent displacement, the arm must be kept steadily bent at right angles, and secured by splints and a circular bandage in that situation, until the union of the coronary ligament has been effected; which will require the lapse of three or four weeks from the accident.

LATERAL DISLOCATION OF THE RADIUS.

Mr. Freeman, surgeon, of Spring-gardens, brought to my house a gentleman of the name of Whaley, aged twenty-five years, whose pony having run away with him, when he was twelve years of age, he had struck his elbow against a tree whilst his arm was bent and advanced before his head. The olecranon was broken, and the radius dislocated upwards and outwards, above the external condyle; and when the arm is bent, the head of the radius passes the os humeri. He has a useful motion of the arm, but neither the flexion nor the extension is complete.

FRACTURES OF THE ELBOW-JOINT.

FRACTURES ABOVE THE CONDYLES OF THE OS HUMERI.

The condyles of the os humeri are sometimes obliquely broken off just above the joint, and the appearance produced is so similar to that of the dislocation of the radius and ulna backwards, that this fracture is very liable to be mistaken for that injury.

Diagnostic mark of the

The appearances of this accident, as will be seen, are like those

of dislocation of the radius and ulna backwards ; and the mode of distinguishing the two injuries is, by the removal of all the marks of dislocation on extension, and by their return so soon as the extension is discontinued ; in general, also, these accidents are detected by rolling the fore arm upon the humerus, when a crepitus may be felt just above the elbow-joint. nature of this accident.

This fracture happens at all periods of life, but much more frequently in children than in persons of advanced age.

Its treatment consists in bending the arm, and drawing it forwards to effect replacement : then a roller should be applied while it is in the bent position. The best splint for it is one formed at right angles, of which the upper portion should be placed behind the upper arm, and the lower portion under the fore arm : a splint must also be placed on the fore part of the upper arm, and both should be confined by straps ; evaporating lotions should be used, and the arm kept in the bent position by a sling. In a fortnight, if the patient be young, passive motion may be gently begun, to prevent the occurrence of ankylosis ; and in the adult, at the end of three weeks a similar treatment is to be pursued. But even after the most careful and judicious means which can be adopted, there is sometimes considerable loss of motion ; and when the accident has not been understood, or has been carelessly treated, the deformity and loss of motion become very considerable.

The period of life at which the accident happens most frequently.
Treatment.

FRACTURE OF THE INTERNAL CONDYLE OF THE OS HUMERI.

The internal condyle of the humerus is frequently broken obliquely from the other condyles and body of the bone ; and the symptoms by which the accident is known are as follow.

First. The ulna appears dislocated from it and from the broken condyle, projecting behind the humerus when the arm is extended. Symptoms of fracture.

Secondly. The ulna resumes its natural situation in bending the arm.

Thirdly. By grasping the condyles, and bending and extending the fore arm, a crepitus is perceived at the internal condyle.

Fourthly. When the arm is extended, the lower end of the os humeri advances upon the ulna, so as to be felt upon the anterior part of the joint.

I saw a girl, a patient of Mr. Steel, of Berkhamstead, who, by a fall upon her elbow, had fractured the olecranon, and also broken the internal condyle of the os humeri, the point of the broken bone having almost penetrated the skin: the cubital nerve had been also injured, for the little finger and half the ring finger were benumbed.

The cause of this accident is a fall upon the point of the elbow. It usually occurs in youth, before the epiphysis is completely ossified; although I have seen it, but less frequently, in age. It is often mistaken for dislocation.

Treatment.

Its treatment consists in applying a roller round the elbow-joint, to keep the bone in complete apposition; in wetting it frequently with spirits of wine and water; in bending the limb at a right angle, and supporting it in a sling; and in beginning with passive motion, in the child, at the expiration of three weeks after the accident, and at the end of a month in the adult, to prevent loss of motion in the joint.

FRACTURES OF THE EXTERNAL CONDYLE OF THE OS HUMERI.

Diagnostic marks of this accident.

This accident is readily detected by the following symptoms. Swelling upon the external condyle, and pain upon pressure; the motions of the elbow-joint, both of extension and flexion, are performed with pain: but the principal diagnostic sign is, the crepitus produced by the rotatory motion of the hand and radius. If the portion of the fractured condyle be large, it is drawn a little backwards, and carries the radius with it; but if the portion be small, this circumstance does not occur. We have two excellent preparations of this accident in the Museum at St. Thomas's Hospital, and in neither case has there been any other than ligamentous union. In one preparation, in which the external condyle is split obliquely, the bone is somewhat thickened; but although this accident had obviously happened long before death, no union

but that by ligament had been produced. The second preparation is a specimen of the transverse fracture of the extremity of the condyle, within the capsular ligament, in which not the least attempt at ossific union can be detected.

It is obvious, therefore, that this principle of ligamentous union extends to all detached portions within a capsular ligament; the vitality of the bone being supported merely by the ligament within the joint. Union by ligament.

This accident usually happens in children, by falls upon the elbow; at least, in the course of my observation, a very large proportion of the cases have been in young persons: I have seen it occur in the adult, but very rarely in advanced age.

The treatment required is the following: A roller is applied around the elbow, and above and below the joint. An angular splint is to be adapted, which should admit the elbow, extend behind the upper arm, and receive the fore arm, so as to support it; a roller should then be bound over the whole to keep it firmly fixed. In the child this splint may be made of stiff pasteboard, bent to the shape of the elbow; but the best mode for its application is, to dip it in hot water and apply it wet, so that it may exactly adapt itself to the form of the limb; it thus becomes the best possible support to the injured arm. Indeed, it may be here observed, that for children this is the best mode of making every support of this kind. The splint is to be worn for three weeks, when passive motion is to be begun; it must be very gentle at first, and may be gradually increased as the pain and inconvenience attending it subside. Treatment.

The result of the case depends upon the seat of the fracture: if the bone be broken very obliquely, a steady and long-continued support of the part will occasion it to unite; for in these cases a considerable portion of the fracture is external to the capsular ligament; but if the whole extent of the fracture be within the ligament, it does not, as far as I have seen, unite by bone, whatever be the means employed. Result of this injury.

FRACTURE OF THE CORONOID PROCESS OF THE ULNA.

A gentleman came to London for the opinion of different surgeons upon the following case.

Case.

Appearances of the fracture of the coronoid process of the ulna.

This gentleman had fallen upon his hand whilst in the act of running; and, on rising, he found his elbow incapable of being bent, nor could he entirely straighten it: he applied to his surgeon in the country, who, upon examination, found that the ulna projected considerably backwards; but that so soon as he bent the arm, it resumed its natural form. He immediately confined the limb in a splint, and kept it in a sling. When I saw this gentleman in town, several months had elapsed since the accident; yet the same appearances, which the surgeon described when he first saw the injury, remained; namely, the ulna projected backwards whilst the arm was extended, but it was without much difficulty drawn forwards and bent, and the deformity was then removed. It was thought, at the consultation that was held about him in London, that the coronoid process was detached from the ulna; and that thus, during extension, the ulna slipped back behind the inner condyle of the humerus.

Dissection.

I had been in the habit of mentioning this case at lecture, for several years; when on one occasion a person was brought to the dissecting-room at St. Thomas's Hospital, who had been the subject of the same accident; and the joint is preserved in our museum. The coronoid process, which had been broken off within the joint, had united by ligament only, so as to move readily upon the ulna, and thus alter the sigmoid cavity of the ulna so much as to allow, in extension, that bone to glide backwards upon the condyles of the humerus.

Treatment.

As to the treatment of this accident, I am doubtful whether any mode can completely succeed; as the coronoid process, like the head of the thigh-bone, loses its ossific nourishment, and has no other than a ligamentous support. Its life is preserved by the vessels of the reflected portions of the capsular ligament upon the

end of the bone, which do not appear capable of supporting the least attempt at ossific union ; nor is any change on the surface of the bone apparent. It will be proper, however, in this accident, to keep the arm steadily in the bent position for three weeks after the injury, and thus to make the ligamentous union as short as possible, by leaving the bone perfectly at rest.

FRACTURE OF THE OLECRANON.

This process of the ulna is not unfrequently broken off, and the accident is followed by symptoms which render the injury so evident, that the nature of the case can scarcely be mistaken. Pain is felt at the back of the elbow, and a soft swelling is soon produced there, through which the surgeon's finger readily sinks into the joint ; the olecranon can be felt in a detached piece, elevated sometimes to half an inch, and sometimes to two inches, above the portion of the ulna, from which it has been broken. This elevated portion of bone moves readily from side to side, but is with great difficulty drawn downwards ; if the arm be bent, the separation between the ulna and the olecranon becomes much greater. The patient has scarcely any power to extend the limb, and the attempt produces very considerable pain ; but he bends it with facility, and if the limb be undisturbed, it is prone to remain in the semiflexed position. For several days after the injury has been sustained, much swelling of the elbow is produced ; there is an appearance of ecchymosis to a considerable extent, and an effusion of fluid ensues into the joint in a much larger quantity than is natural ; but the extent to which these symptoms proceed, depends upon the violence which produced the accident. The rotation of the radius upon the ulna is still preserved. No crepitus is felt, unless the separation of the bone be extremely slight.

Symptoms
of fracture of
the olecranon.

DISSECTION OF THIS ACCIDENT.

This fracture is usually found to have happened through the centre of the olecranon ; and it is most frequently in the transverse

Appearances of
the dissection
of this accident.

direction ; but I have seen the bone broken obliquely, so that the fractured parts presented very thin edges. On that portion of the olecranon attached to the ulna there are some marks of ossific inflammation, and some very slight traces of it on the detached portion. The cancellated structure of the fractured olecranon is filled by ossific matter, and is sometimes smoothed by occasional friction. The os humeri and radius undergo no change. In the appearances of one case which I dissected, and of which I have given a plate, the olecranon is separated two inches from the ulna ; the capsular ligament of the elbow-joint is torn through on each side of the olecranon ; and the separated portion is united by a ligamentous band, which is stretched from one broken extremity of the bone to the other.

Mode of union. The nature of this injury, then, is as follows. So soon as the extremity of the bone is broken off, it is, by the action of the triceps muscle, drawn up from half an inch to two inches from the ulna, and the extent of its separation depends upon the degree of laceration of the capsular ligament, and of that portion of the ligamentous band which proceeds from the side of the coronoid process of the ulna to that of the olecranon. That I might perfectly understand the nature of this accident, and its means of separation, I tried the following experiments on a dog.

Experiments.

On a dog. The integuments having been drawn laterally and firmly over the end of the olecranon, I made a small incision, and placed a knife upon the middle of that process, in a transverse direction ; on striking it with a mallet, the bone was readily cut through ; a separation directly took place by the action of the triceps muscle ; adhesive matter was effused ; and when I examined the limb a month afterwards, I found the bone united by a strong ligament. I broke the olecranon in the same manner in several rabbits : in these experiments blood was first thrown out, and then adhesive matter filled up the space of separation, which subsequently be-

came ligamentous, and firmer and firmer, as the time was protracted between the experiment and examination.

As I found that ligament was formed in each of these experiments, I was anxious to learn whether the olecranon could be made to unite by bone, if a longitudinal fracture were produced with but slight obliquity, so that the broken portions might still remain in contact; and I found that, under these circumstances, the osseous union readily took place. Therefore, this bone, like the extremity of the os calcis when it is broken off, is detached by the action of muscles, and ligamentous union ensues from want of adaptation: but a different cause exists where bony union fails in fractured bones within joints, in the neck of the thigh-bone, in the coronoid process of the ulna, and in the extremity of the external condyle of the os humeri. In these injuries the want of union proceeds from the diminished support which the fractured parts receive; the little that exists being derived through the medium of blood-vessels intended for the nourishment of ligament. The preparations made from these experiments may be seen in the Museum at St. Thomas's Hospital. I have also seen this bone in the living person united by an ossific process, when the fracture has happened very near to the shaft of the ulna.

Union in fractured olecranon depending on adaptation.

The ligamentous substance which generally forms the bond of union in these cases, is often incomplete; having an aperture, and sometimes several apertures in it, when it is of considerable length. The arm is weakened in proportion to the length of the ligament; for if this be very long, extension of the arm is rendered difficult, from the necessarily diminished power of the triceps muscle.

The causes of this injury are, first, a fall upon the elbow when the joint is bent; and secondly, fracture by the action of the triceps muscle only, when a great and sudden exertion is made during the flexed position of the arm.

Causes of this injury.

The treatment of this accident is as follows, but it is to be modified according to the degree of injury. If there be much swelling and contusion, it is right to apply evaporating lotions and leeches for two or three days; and after the inflammation is re-

Treatment of fracture of the olecranon.

Principle of treatment.

duced, a bandage should be applied; but in those cases where but little violence is done to the limb, it should be at once secured by bandage. The principle of the treatment is to preserve the power of the limb, by making the separation of the bones as slight as possible, that their ligamentous union may be shortened; and secondly, to restore the natural motions of the joint. If the swelling and inflammation do not prevent it, the surgeon is to place the arm in a straight position, and to press down the upper portion of the fractured olecranon until he brings it in contact with the ulna; a piece of linen is then laid longitudinally on each side of the joint, a wetted roller is applied above the elbow, and another below it; the extremities of the linen are then to be doubled down over the rollers and tightly tied, so as to cause an approximation: thus the bones are brought and held together: a splint well padded is to be applied upon the fore part of the arm, to preserve it in a straight position, and it is to be confined to it by a circular bandage; the whole is to be frequently wetted with spirits of wine and water.

Position.

This is the only injury of the elbow-joint which requires the straight position; those of the condyles and coronoid process demanding that the limb should be kept bent.

Removal of splints.

In a month the splint is to be removed and passive motion is to be begun; but if it be attempted earlier, the olecranon will separate from the shaft of the bone, and the ligament become lengthened and weakened. All attempts at motion must be made with the greatest gentleness.

Fracture of the olecranon an inch from the point of the elbow into the body of the ulna, requires the same treatment as the common fracture of this portion of bone.

Case.

Miss —, aged thirty, fell from her horse on her elbow, and broke the ulna one inch from the point of the olecranon. It was kept bent three months, and no extension could be produced by any effort of herself. I forcibly straightened the arm, and kept it so by a wooden splint.

Bony union may, in this case, be readily produced.

COMPOUND FRACTURE OF THE OLECRANON.

In compound fractures of this bone, the edges of the skin must be brought into exact apposition; lint, embued in blood, must be applied on the wound, with adhesive plaster over it, and union by adhesion must be effected if possible; but in other respects the treatment is the same as in simple fracture.

I have seen two cases of this accident, both of which have been successfully treated.

FRACTURE OF THE NECK OF THE RADIUS.

This fracture I have heard mentioned by surgeons as being of frequent occurrence; but there must be some mistake in the statement, for it is an accident which I have never seen; and if instances ever present themselves (which I do not mean to deny) they must be very rare.

The injury would be known by fixing the external condyle of the humerus and rolling the radius, when a crepitus would be perceived. Diagnostic marks of this accident.

If such an accident should occur, the treatment which it will require will be the same as that which is demanded for fracture of the external condyle of the os humeri.

COMPOUND FRACTURES AND DISLOCATIONS OF THE ELBOW-JOINT.

These generally happen through the internal condyles of the os humeri, and the fracture takes an oblique direction into the joint. In the most severe accident of this kind, the constitution is generally able to support the injury, if it be judiciously treated; and the recital of the following cases will evince the happy result that may be expected, if union by adhesion be effected in the treatment. Generally not destructive.

I was called to Guy's Hospital, to see a brewer's servant, who Case. had a compound fracture of the elbow-joint, caused by his dray passing over his arm, which had considerably comminuted the bones. I could pass my finger readily into the joint, and feel the brachial artery pulsating on its fore part. Considering the violence

done to the part, and the constitution of the patient, who, like most of those in such employment, drank much porter and spirits, and ate but little, I at once told him, I feared there was scarcely any hope of his recovery, unless he consented to the loss of his limb; the man, however, determined not to submit to the operation, although Dr. Hulme, who accompanied me, also endeavoured to convince him of the necessity of amputation; I therefore did all in my power to save both his life and his limb. The bones were easily replaced, and the parts were carefully brought together. The limb was laid upon a splint, lightly bandaged, and placed at right angles. The wound united without any untoward circumstance; and the only check that interrupted his progressive recovery, was the formation of an abscess in the shoulder, which was opened, and immediately healed. The elbow-joint was not even completely ankylosed, for he retained sufficient motion in it to allow him to resume his former occupation.

Treatment of compound fractures of the elbow-joint.

In all cases of this accident, the arm should be kept in the bent position; for as ankylosis, in a greater or less degree, is the certain consequence, it is attended with much less inconvenience in this position than in any other. If the bones be much comminuted, and the wound large, all the detached portions of bone should be removed; but in old people, when much injury is done, there is often not sufficient strength to support the adhesive process, and amputation should be recommended. The edges of the wound should be kept together by placing a piece of lint, dipped in blood, over them, supported by adhesive plaster, and a bandage, lightly applied, wetted with spirits of wine and water.

STRUCTURE OF THE WRIST-JOINT.

Structure of the joint.

Bones.

The radius and the three first bones of the carpus, form the articular surfaces of the wrist-joint; the radius having an oval cavity at its lower extremity, which receives the rounded surfaces of the scaphoid, lunar, and cuneiform bones. The articular cartilage which covers this surface of the radius is, at its inner edge, extended beneath the ulna, so as to exclude that bone from the gene-

ral cavity of the wrist-joint. This articular cartilage is hollow, both above and below; and at its lower surface it rests upon the os cuneiforme.

A capsular ligament passes from the edge of the articular cavity of the radius, and from the inter-articular cartilage of the ulna, to the three first bones of the carpus, surrounding a large portion of the scaphoid and lunar bones, and but a small surface of the cuneiform. Capsular ligament.

The second joint at this part is that formed between the radius and the ulna. On the inner side of the lower extremity of the radius is situated a hollow articulatory surface, which receives an articular surface on the outer side of the ulna, and both are covered by an articular cartilage. At the lower part of this joint is placed the inter-articular cartilage of the ulna, the outer edge of which is joined to the articular cartilage of the radius, and its inner edge is united to the ulna by ligament, which sinks into a cavity formed at the lower extremity of this bone, between the styloid process of the ulna and its rounded extremity. Ulna-joint.

The capsular ligament, which unites the ulna to the radius, is called the sacciform ligament: it covers the articular surfaces of the two bones, and is united below to the moveable cartilage of the ulna. This joint of the wrist is formed for the purpose of supporting the rotatory motion of the radius upon the ulna, and of strongly uniting one bone to the other. Sacciform ligament.

The wrist is strengthened on each side by peculiar ligaments: one proceeds from the styloid process of the radius, to be fixed to the outer edge of the scaphoid bone, which is the *radio-carpal ligament*; and an *ulna-carpal ligament* extends from the styloid process of the ulna, to the os cuneiforme, and os orbiculare. Radio-carpal.
Ulna-carpal.

DISLOCATIONS OF THE WRIST-JOINT.

THE dislocations of this joint are of three kinds:—

First, dislocation of both bones.

Secondly, dislocation of the radius only.

Thirdly, dislocation of the ulna.

Mode in which
these accidents
happen.

The first accident, namely, the dislocation of both bones, is not of very frequent occurrence; but when it does happen, the bones are thrown either backwards or forwards, according to the direction in which the force is applied. If the person in falling puts out his hand to save himself, and falls upon the palm, a dislocation is produced, the radius and ulna are forced forwards upon the ligamentum carpi annulare, and the carpal bones are thrown backwards.

Appearance.

The appearances of this dislocation are these:—A considerable swelling is produced by the radius and ulna, on the fore part of the wrist, with a similar protuberance upon the back of the wrist by the carpus, with a depression above it; the hand is bent back, being no longer in the line with the fore arm.

In the dislocation of the radius and ulna backwards, the person falls upon the back of the hand, the radius and ulna are thrown upon the posterior part of the carpus, and the carpus itself is forced under the flexor tendons, which pass behind the ligamentum carpi annulare: but in each of these cases, two swellings are produced, one by the radius and ulna, and the other by the bones of the carpus, according to the direction in which they are thrown; and these become the diagnostic signs of the accident.

Sprains.

Severe falls upon the palm of the hand will produce sprains of the tendons on the fore part of the wrist, and occasion a very considerable swelling of the flexor tendons, opposite the wrist-joint. This accident assumes the appearance of dislocation, but may always be distinguished from it by the existence of one swelling only, which does not appear immediately after the injury is received, but succeeds it gradually. And further, if the surgeon be called directly after the dislocation has happened, there is then a great flexibility of the hand, as well as distortion, and the extremities of the radius and ulna on one side, and of the carpal bones on the other, are easily detected.

Reduction.

The reduction of this dislocation, in whatever form it may have occurred, is by no means difficult. The surgeon grasps the patient's hand with his right hand, supporting the fore arm with his

left, whilst an assistant places his hands around the upper arm, just above the elbow; they then pull in different directions, and the bone becomes easily replaced. The reduction is, in both cases, the same; for the muscles draw the bones towards their natural position as soon as they are separated from the carpus by extension.

When the hand recovers its natural situation, a roller, wetted in spirits of wine and water, is to be lightly applied around the wrist, and the whole is to be supported by splints placed before and behind the fore arm, reaching as far as the extremities of the metacarpal bones, for the more perfect security of the limb.

DISLOCATION OF THE RADIUS AT THE WRIST.

This bone is sometimes separately thrown upon the fore part of the carpus, and lodged upon the scaphoid bone and the os trapezium. The outer side of the hand is, in this case, twisted backwards, and the inner forwards: the extremity of the radius can be felt and seen, forming a protuberance on the fore part of the wrist. The styloid process of the radius is no longer situated opposite to the os trapezium.

Diagnostic
marks of this
accident.

This accident usually happens from a fall when the hand is bent back; and I have also known it arise from a fall upon the hand, by which the condyles of the os humeri were broken obliquely, and the radius dislocated at the wrist, being thrown upon the fore part of the scaphoid bone, where it could be distinctly felt: this was the case of the lad whom I mentioned when speaking of fractures of the os humeri; his hand was hanging backwards, and he felt great pain upon its being moved.

Cause of the
accident.

The extension necessary to reduce a dislocation of the radius, and the treatment which it demands, are the same which are required for the luxation of both bones; and there is no difficulty in the operation, the hand being extended whilst the fore arm is fixed.

DISLOCATION OF THE ULNA.

As this bone does not form a part of the wrist-joint, but is received into a capsular ligament of its own, and is separated from the wrist by a moveable cartilage, it is more frequently dislocated, separately, than the radius.

Symptoms.

When this accident occurs, the sacciform ligament is torn through, and the bone generally projects backwards, without any accompanying fracture of the radius. It rises and forms a protuberance at the back of the wrist; and although it is easily pressed down into its natural position, yet so soon as the pressure is removed the deformity returns, as the lacerated ligament has no longer the power to retain it in its place.

Diagnostic marks.

The diagnostic marks of the injury are, the projection of the ulna much above the level of the os cuneiforme, and altered position of the styloid process, which is no longer in a line with the metacarpal bone of the little finger.

Mode of reduction.

The reduction is accomplished by pressure of the bone forwards, which brings the ulna into its natural articular cavity by the side of the radius; and to retain it in this situation, splints must be placed along the fore arm, in a line with the back and palm of the hand; the splints should be padded throughout; but upon the extremity of the ulna a compress of leather should be placed, to keep it in a line with the radius; a roller should then be applied over the splints to confine them with sufficient firmness.

COMPOUND DISLOCATION OF THE WRIST, ULNA PROJECTED, AND FRACTURE OF THE RADIUS.

Case.

John Winter fell from a ladder on his hand and knee; the hand was bent back, and the ulna protruded at the inner part of the wrist. Mr. Steel, of Berkhamstead, attended; the bone was reduced, a roller was put around the wrist, and the wound healed very soon by adhesion. In seven weeks he was well, excepting that a slight swelling of the tendons remained for a few weeks longer.

SIMPLE FRACTURE OF THE RADIUS, AND DISLOCATION
OF THE ULNA.

The radius is frequently broken, and the ulna at the same time dislocated; the fracture usually happens one inch above the articulation. If it occurs in a very oblique direction, so great a displacement of the radius ensues, that dislocation of the ulna forwards is also produced.

A frequent accident.

There is a preparation of this accident in the museum of St. Thomas's Hospital. The lower end of the radius is seen in its natural situation, articulated with the carpal bones. An inch above the ligamentum annulare carpi, the broken extremity of the radius is seen projecting under the flexor tendons of the wrist, which have been removed to shew its situation; the ulna is dislocated forwards, and rests upon the os orbiculare.

Dissection.

The signs of this injury are, that the hand is thrown back upon the fore arm, so as at first sight to exhibit the appearance of a dislocation of the hand backwards; and a projection of the ulna is felt under the tendon of the flexor carpi ulnaris muscle, just above the os orbiculare; and, thirdly, the fractured extremity of the radius is easily detected, under the flexor tendons of the hand. I have seen this accident frequently, and at first did not exactly understand the nature of the injury; indeed, dissection alone taught me its real character.

Diagnostic marks of this accident.

A very powerful extension is required to bring the broken ends of the radius in apposition, and great difficulty exists in confining them when this is effected. The hand is to be extended by the surgeon, and the fore and upper arm are to be drawn back by an assistant; then a cushion is to be placed upon the inner part of the wrist, and another to the back of the hand, firmly bound down by a roller, for the purpose of keeping the ulna and broken end of the radius in situ; a splint, well padded, is then to be applied to the back part and inner side of the fore arm, which is to extend to the extremities of the metacarpal bones; these splints are to be confined by a roller, reaching from the upper part of the fore arm

Mode of reduction and its difficulties.

to the wrist, and no further. The arm should be then placed in a sling: this position is to be preserved for three weeks in young persons, and for four or five in the aged, before passive motion be attempted. The recovery in these cases is slow; and six months will sometimes elapse before motion of the fingers is completely restored.

FRACTURE OF THE LOWER END OF THE RADIUS WITHOUT
DISLOCATION OF THE ULNA.

Symptoms of
this accident.

This fracture generally happens about an inch above the styloid process. The cure is difficult, the lower extremity of the broken bone being drawn by the action of the pronator quadratus amongst the flexor tendons, where it may be distinctly felt: in this situation it interferes very considerably with the motions of the fingers, by confining the action of the flexor profundus perforans. Mr. Cline, in his lectures on this subject, used, nearly in these terms, to recommend the following treatment:—"When a fracture of the radius happens just above the wrist-joint, you must be very careful in your treatment of it, to prevent the injury from leading to the permanent loss of the use of the fingers; for so soon as the injury has happened, the pronator quadratus muscle draws the fractured end of the bone obliquely across the fore arm, amidst the flexor tendons; your object, therefore, in the treatment of this accident is, to prevent the action of the pronator from producing that effect; and the mode of treatment which you are to adopt is, to make the hand, by its weight, oppose the action of that muscle. For this purpose, when the bone has been placed in its right position, by drawing the hand in a line with the fore arm, apply a roller around the fore arm to the wrist; then a splint upon the fore and back part of the arm to reach the palm and back of the hand, so as to preserve it in a half supine position; and confine the splints by means of a roller, which should reach only to the wrist. The arm is then to be placed in a sling, which is also to support it no further than to the wrist. Thus the hand, being allowed to hang between the ends of the splints, draws the end of the radius, so as to

Treatment.

maintain a constant extension upon it, opposing the action of the pronator quadratus muscle, and keeping the broken end of the bone constantly in its place."

COMPOUND DISLOCATION OF THE ULNA, WITH FRACTURE
OF THE RADIUS.

This is a very serious accident when the radius is much comminuted; but recovery proceeds very well when the radius is broken without being shattered. I saw a case of this injury in Hertfordshire, in which the man met with the accident by falling upon the back of his hand, and the ulna protruded an inch and a half through the integuments. The bone was immediately reduced and bandaged; the wound healed by the adhesive process, and the man recovered the perfect use of his limb.

Often a very serious accident.

A man was admitted into St. Thomas's Hospital, under the care of Mr. Chandler. I now forget in what manner the accident had happened, but the ulna projected through the integuments at the back of the carpus: and a compound fracture of the radius, with great comminution of the bone, was produced. The ulna was at first replaced, but immediately resumed its dislocated position on the back of the wrist, although it did not again protrude through the skin. The hand and fore arm were placed in a poultice, and were ordered to be fomented twice a day. A copious suppuration ensued, attended with violent constitutional irritation; and Mr. Chandler, in order to save the patient's life, after a lapse of five weeks, amputated the limb.

Case.

On dissection, I found the ulna dislocated backwards, and its extremity just drawn within the opening of the integuments, through which it had protruded. The radius was broken into several pieces, some of which being loose, were necessarily a great source of irritation; the tendons and muscles were some of them lacerated, as the extensor carpi radialis longior, and the extensors of the thumb.

Dissection.

In a similar case, it would be proper, when loose pieces of bone can be felt at the extremity of the radius, that the wound should

Treatment.

be enlarged for their removal; and instead of fomentations and poultices, a quantity of lint, dipped in the patient's blood, should be applied round the wrist, lightly bound with a roller. The arm should be supported upon a splint, so as to be kept perfectly free from motion; evaporating lotions should be applied; and the limb should not be disturbed, unless the patient has symptoms of a suppurative process, when a small opening should be made in the bandage to allow of the escape of pus, but still the bandages should be suffered to remain. The patient should be bled from the arm if the inflammation and constitutional irritation be considerable; and, under these circumstances, leeches should be occasionally applied. The bowels should be kept gently open, but all active purging avoided.

DISLOCATIONS OF THE CARPAL BONES.

Carpal joint.

The eight bones of the carpus are joined to each other by short ligaments, which pass from bone to bone, allowing but a very slight degree of motion of one bone upon another; but besides this mode of articulation, there is a transverse joint between the first and second rows of carpal bones, forming a complete ball and socket. The ball is produced by the rounded extremities of the os magnum and os cuneiforme; the cup, by the scaphoid, lunar, and cuneiform bones. A ligament passes from one row of bones to the other, including this articulation.

The dislocation of a carpal bone is but of rare occurrence; the following is an example of the accident.

Case.

Mary Nicholls, aged sixty, slipped down, and, trying to save herself, fell upon the back of her hand, and fractured the radius obliquely outwards, through the lower articulating surface. The fractured portion, with the os scaphoides, was thrown backwards upon the carpus. The wrist was slightly bent, and there was an evident projection at the back of the carpus. The fingers could be completely extended, but only semiflexed. A crepitus might be distinctly felt, either by moving the hand, or the styloid process of the radius backwards or forwards. By slight extension, and steady

pressure upon the displaced part, the fracture was easily reduced. There was much extravasation and pain; six leeches were applied, afterwards evaporating lotions, and two long splints; and as soon as the swelling had in some measure subsided, strips of soap plaster. At the end of six weeks the fracture was firmly united; but the motions of the wrist are still imperfect, and she cannot grasp any thing.

Ganglia are sometimes mistaken for this accident; but in such cases a smart blow with a book will disperse the swelling, and dispel the cloud of doubt which enveloped the mind of the surgeon.

The os magnum and the cuneiform bones, from relaxation of their ligaments, are occasionally thrown somewhat out of their natural situation, so that when the hand is bent, they form protuberances at the back of the wrist. This state is productive of so great a degree of weakness, as to render the hand useless unless the wrist be supported. Relaxation of the carpal joint.

I was consulted by a young lady, a patient of Mr. Cumming of Chelsea, who had such a projection of the os magnum, that she was, in consequence, obliged to give up her music and other accomplishments, on account of the attendant weakness; for when she wished to use her hand, she was compelled to wear two short splints, which were adjusted to the wrist, and bound upon the back and fore part of the hand and fore arm. Another lady, who had a weakened state of limb, arising from a similar cause, wore, for the purpose of giving it strength, a strong bracelet of steel chain, clasped very tightly around the wrist.

But the supports generally directed to be worn in these cases are straps of adhesive plaster, and a bandage over the wrist to confine and strengthen it. The effusion of cold water upon the hand from a considerable height is also employed, and the part is afterwards rubbed with a coarse towel, to give vigour to the circulation, and strength to the joints.

COMPOUND DISLOCATION OF THE CARPAL BONES.

These accidents are of frequent occurrence, and they are generally caused by guns bursting in the hand; portions of the instrument being forced through the carpus, and between the metacarpal bones.

In these cases a carpal bone may be removed by dissection, and the patient may recover; not only saving his hand, but in a considerable degree, preserving its motions.

When only one or two of the carpal bones are displaced by guns bursting in the hand, they may be dissected away; but if more considerable injury be done, amputation will be necessary.

DISLOCATIONS OF THE METACARPAL BONES.

Amputation
often necessary.

These bones are so firmly articulated with the bones of the carpus, that I have never seen them dislocated but by the bursting of guns, or by the passage of heavy laden carriages over the hand; and in each of these cases there is generally so much injury produced as to render amputation necessary. In the former of these accidents, a bone, and sometimes two, are capable of being removed; and if it be necessary to amputate the middle and ring fingers, the fore and little fingers may be brought so nicely together, and secured in such exact adhesion, as to produce little deformity.

Case.

I was called by Mr. Hood, surgeon at Vauxhall, to a Mr. Waddle, of Bow-lane, Cheapside; who, while shooting, had his gun burst, and his hand lacerated by a portion of the barrel passing through its centre. The metacarpal bones of the middle and ring fingers were fractured, and also much comminuted by the violence of the injury; but the integuments were only lacerated, and not completely removed. I dissected out the two fingers, with the metacarpal bones which supported them, and brought the edges of the skin together by suture, approximating the fore and little fingers, and applying a roller so as to bind them together; the parts united perfectly, and the maimed hand was afterwards extremely useful to him; the case, indeed, is highly worthy of inspection.

A boy of twelve years of age was brought into Guy's Hospital, Case. who, by the bursting of a gun, had his thumb and all the fingers excepting the fore finger blown to pieces; the whole hand was exceedingly shattered, and the metacarpal bones were separated from the carpus. Upon examination of the hand, I found that the tendon of the fore finger was uninjured, so that its use remained perfect; and as the integuments could be still saved, so as to cover its metacarpal bone, I dissected out the trapezium (the thumb had been entirely carried away by the concussion) and the metacarpal bones of all the fingers, excepting that of the fore finger, which was afterwards of the greatest use to him. I kept him for some time at the hospital, to shew to the students the restorative powers of nature, and the utility of this finger saved out of the wreck of his hand; he used it as a hook with the greatest facility.

FRACTURE OF THE HEAD OF THE METACARPAL BONE.

The extremity of the metacarpal bone towards the fingers, Fracture. which is called its head, is sometimes broken off; which produces the appearance of dislocation of the finger, as the head of the bone sinks towards the palm of the hand. In the treatment of this case, a large ball is to be grasped in the hand, which should be bound over by a roller; and thus the depressed extremity of the bone is raised to its natural situation.

DISLOCATIONS OF THE FINGERS AND TOES.

The phalanges of the fingers and toes are united by capsular liga- Structure. ments to the metacarpal and metatarsal bones, and to each other; and their union is further strengthened by lateral ligaments, proceeding from one side of the phalanx to the other. Posteriorly, they are defended by the tendon of the extensor muscle of the fingers; and anteriorly, by the thecæ and flexor tendons. Dislocation of the phalanges, therefore, is but rare: but when this accident does occur, it more frequently happens between the first and second phalanges than between the second and third.

The second phalanx being thrown forwards towards the thecæ, and the first backwards, I could not learn if the ligaments had been torn, as the dislocation had existed for a length of time, and the ligament, if it had ever been lacerated, was then united; the extensor tendon was very much stretched over the end of the first phalanx.

Diagnostic
marks of this
accident.

This accident may be readily distinguished by the projection of the first phalanx backwards, while the head of the second may be, although less distinctly, felt under the thecæ.

The reduction may be effected by making extension with a slight inclination forwards to relax the flexor muscles. If the bone has not been dislocated many hours, it is easily reduced; but if neglected at first, this can only be accomplished by a long-continued extension, very steadily applied. I have seen too much mischief arise from injury to the tendons and ligaments of these joints never to recommend the division of them (which some have advised) to facilitate the reduction, when extension will not succeed. The observations which I have made respecting the dislocation of the fingers, also apply to the toes; of which, however, the dislocations are more difficult to reduce, from their greater shortness, and the less pliability of the joints.

DISLOCATION FROM CONTRACTION OF THE TENDON.

Contraction of
tendon.

A toe or finger is sometimes gradually thrown out of its natural direction by a contraction of the flexor tendon and thecæ, and the first and second phalanges are consequently drawn up and projected against the shoe, so as to prevent the patient from being able to take his usual exercise.

Amputation re-
quired.

I have frequently seen young ladies subject to this inconvenience in the toe, and attributed it to the tightness of their shoes. It appears an extremely harsh measure on the part of the surgeon to amputate a toe under such circumstances, yet it is sometimes absolutely necessary, as the contraction deprives the person of exercise, and many of the enjoyments of life.

In the first person whom I saw with this state of the toe, I refused to amputate, fearful of tetanus being produced by the

operation; but the lady went to another surgeon, who complied with her request, and she did very well. In consequence of the perfect recovery of this lady, and the comfort which she derived from the loss of the annoyance, I was induced, at the request of Mr. Toulmin, of Hackney, to remove one of the toes from a patient of his, which was constantly irritated by the pressure of her shoe in walking, and prevented her from taking the exercise necessary to the preservation of her health; she did very well, perfectly recovering the use of her foot.

The fingers are sometimes contracted in a similar manner by a chronic inflammation of the thecæ and aponeurosis of the palm of the hand, from excessive motion of the hand, in the use of the hammer, the oar, ploughing, &c. When the thecæ are contracted, nothing should be attempted for the patient's relief, as no operation or other means will succeed; but when the aponeurosis is the cause of the contraction, and the contracted hand is narrow, it may with advantage be divided by a pointed bistoury, introduced through a very small wound in the integument. The finger is then extended, and a splint is applied to preserve it in the straight position. Division of
aponeurosis.

Some time since, my nephew, Mr. Bransby Cooper, who was transacting my business during my absence from town, performed this operation for a Lincolnshire farmer, who, by this impediment, had been prevented following his avocations; and he perfectly recovered the use of his foot.

DISLOCATION OF THE THUMB.

These accidents are very difficult to reduce, on account of the numerous strong muscles which are inserted into the part.

The thumb consists of three bones:—its metacarpal bone and two phalanges. The metacarpal bone of the thumb is articulated with the os trapezium by means of a double pulley; that of the trapezium directing the thumb towards the palm of the hand, and that of the metacarpal bone directing it laterally. The metacarpal bone is connected with the trapezium by a capsular ligament, and

a very strong ligament joins the first phalanx to the palmar part of the trapezium, at its lower extremity. The metacarpal bone forms a rounded projecting articular surface, upon which the hollow of the first phalanx rests, both being surrounded by a capsular ligament, and strengthened by two strong lateral ligaments. There are eight muscles inserted into the thumb: two into the metacarpal bone, as the extensor and flexor ossis metacarpi; two into the first phalanx, the flexor brevis pollicis, and the extensor primi internodii; the abductor and adductor pollicis are also inserted into the first phalanx, through the medium of the sesamoid bones; the extensor secundi internodii and flexor longus pollicis are inserted into the second phalanx. These muscles necessarily offer great resistance to the reduction of dislocations, and therefore those of the thumb are amongst the most difficult to reduce, if any considerable time be allowed to elapse before the attempt be made.

DISLOCATION OF THE METACARPAL BONE FROM THE OS TRAPEZII

Symptoms.

In the cases which I have seen of this accident, the metacarpal bone has been thrown inwards, between the trapezium and the root of the metacarpal bone supporting the fore finger; it forms a protuberance towards the palm of the hand; the thumb is bent backwards, and cannot be brought towards the little finger. Considerable pain, with swelling, is produced by this accident.

Mode of reduction.

For the facility of reduction, as the flexor muscles are much stronger than the extensors, it is best to incline the thumb towards the palm of the hand during extension; and thus the flexors become relaxed, and their resistance diminished. The extension must be steadily supported for a considerable time, as no sudden violence will effect the reduction. If the bone cannot be reduced by simple extension, it is best to leave the case to the degree of recovery which nature will in time produce, rather than divide the muscles, or run any risk of injuring the nerves and blood-vessels.

Compound luxation.

This bone is sometimes dislocated by the bursting of a gun, which produces compound luxation; in these cases it may be

returned without difficulty to its natural situation. The integuments being brought and confined over the bone by suture, a poultice is applied ; and under common circumstances, where the degree of bruise has not been very considerable, a cure is perfected. Sometimes, however, the metacarpal bone becomes so much detached from the trapezium, and the muscles are so severely torn, that it is necessary to remove the thumb ; in which case, it is best to saw off the articular surface of the trapezium. Such a case happened lately to a servant of Mr. Grover, of Hemel Hempstead ; the metacarpal bone of the thumb was dislocated, and the muscles were so much lacerated that it became necessary to remove the thumb at the os trapezium : but the articular surface of the trapezium projected so far, that the integuments could not be brought over it ; I therefore directed this surface to be sawn off, through the os trapezium ; and a poultice being applied, the man recovered by the granulating process.

DISLOCATION OF THE FIRST PHALANX.

This accident may be either simple or compound. In the simple dislocation the first phalanx is thrown back upon the metacarpal bone ; the lower extremity of the latter projects very much inward towards the palm of the hand, and the extremity of the phalanx projects backwards. The motion of that joint is lost, but that of the thumb, through the medium of the metacarpal bone and trapezium, remains free ; so that as an opponent to the fingers its power of action continues : but with respect to flexion and extension, which are performed between the metacarpal bone and the first phalanx, they are destroyed by the dislocation.

Diagnostic marks of simple dislocation of the first phalanx.

The extension is to be made by bending the thumb towards the palm of the hand, to relax the flexor muscles as much as possible ; and the following is the general mode to be adopted in dislocations of the toes, thumb, and fingers. The hand is to be first steeped in warm water for a considerable time, to relax the parts as much as possible ; then a piece of thin wetted leather, wash-leather for instance, is to be put around the first phalanx and as closely

Mode of reduction.

adapted to the thumb as possible; a portion of tape, about two yards in length, is then to be applied upon the surface of the leather, in the knot which is called by sailors the *clove hitch*, for this becomes tighter as the extension proceeds. An assistant places his middle and fore fingers between the thumb and fore finger of the patient, and makes the counter-extension; whilst the surgeon assisted by others, draws the first phalanx from the metacarpal bone, directing it a little inward towards the palm of the hand.

The extension should be supported for a considerable length of time, and if success does not attend the surgeon's efforts, it is right to adopt the following plan. The leather and sailor's knot are to be applied as above, and a strong worsted tape is to be carried between the metacarpal bone of the thumb and the fore finger: the arm is then to be bent around a bed-post, and the worsted tape fixed to it: a pulley is then to be hooked to the tape which surrounds the first phalanx, and extension is to be made; this mode is almost sure to succeed. If, however, under the steadiest, best directed, and most persevering attention, the bone be not reduced, a disappointment which will sometimes happen in dislocations which have been neglected, then the surgeon's efforts must cease; no operation for the division of parts should be made, as the patient will have a very useful thumb after a time, even without reduction.

Treatment of compound dislocation of the thumb.

In compound dislocations of the first phalanx of the thumb, if there be much difficulty in its reduction, and the wound be large, it is best to saw off the extremity of the bone, rather than to bruise the parts by long-continued extension; they are to be healed by adhesion; and if passive motion be begun early, a joint will soon be formed, and a very useful member remain. In this case, lint, dipped in blood, is to be applied to the wound; a roller must be bound round, and the part kept cool by evaporating lotions for several days, until the wound be healed.

I very recently saw the following case of *compound dislocation*.

A gentleman came to my house, whose first phalanx had been

thrown upon the back of the metacarpal bone of the thumb by the bursting of a gun. The flexor muscles and the abductor were much lacerated just below the os trapezium: the extensors were not injured. I applied the tape to the first phalanx, and extending, easily reduced it: I then brought the edges of the integuments together by suture, directing a poultice to be applied, on account of the great contusion of the parts; and the recovery was very complete.

DISLOCATION OF THE SECOND PHALANX.

If this be a simple dislocation the best mode of reducing it is, Simple. for the surgeon to grasp the back of the first phalanx with his fingers, apply his thumb upon the fore part of the dislocated phalanx, and then bend it upon the first as much as he possibly can.

In compound dislocations of this joint, it is best to saw Compound. off the extremity of the second phalanx, taking care not to injure the tendon which is torn through; for when the bone is removed, the ends of the tendon may be readily approximated, and adapted to each other. The extremity of the tendon should be smoothed by a knife, the part bound up in lint dipped in blood, and confined by a roller: it should be kept quiet for two or three weeks, when passive motion may be begun.

DISLOCATIONS OF THE RIBS.

Authors describe different species of dislocations of the ribs: their heads are said to be thrown from their articulation with the vertebræ forwards upon the spine. If this accident ever does occur, it is certainly extremely rare, and must be very difficult of detection.

A person by falling on his back upon some pointed body, may, Heads of ribs. however, receive a blow upon his ribs, by which they may be driven from their articulations.

Such an injury would produce the usual symptoms of fracture Symptoms.

of these bones: their motions would be painful, and respiration necessarily difficult.

Treatment.

The treatment which would be required, would also be the same as that which is pursued in fracture of the ribs: viz., the abstraction of blood, and the application of a circular bandage: the former to prevent inflammation of the pleura and lungs: the latter to lessen the motion of the ribs. Any attempt made to effect their reduction would be entirely fruitless.

Cartilages.

The cartilages connecting the ribs with the sternum, frequently appear to have been dislocated from the extremities of the ribs, and sometimes from the sternum. Mothers have several times brought their children to me, saying, "My child has some time since had a fall, and see how the form of its breast is altered." The sixth, seventh, and eighth cartilages of the ribs are most frequently the subjects of this alteration of form; and when the ribs are carefully examined, it is found that their natural arch is diminished, their sides flattened, and, consequently, the extremities of the ribs, with their cartilages, thrust forward. The appearance which is thus produced is the result of constitutional weakness, and not of the accident to which it is attributed.

Cartilage forcibly separated.

The termination of the cartilages at the sternum sometimes projects from a similar cause, giving rise to the same false impressions upon the minds of the parents, that the circumstance must have arisen from accident, and not from disease. Sometimes however, but very rarely, a cartilage is torn from the extremity of the rib, and projects over its surface; when this happens, a similar treatment is required as in fracture of the ribs. The patient is to be directed to make a deep inspiration, and then the projecting cartilage is to be pressed into its natural situation; a long piece of wetted pasteboard should be placed in the course of three of the ribs and their cartilages, the injured rib being in the centre: this dries upon the chest, takes the exact form of the parts, prevents motion, and affords the same support as a splint upon a fractured limb. A flannel roller is to be applied over this splint, and a

Treatment.

system of depletion pursued, to prevent inflammation of the thoracic viscera.

INJURIES OF THE SPINE.

It has been generally stated by surgeons that dislocations of the spinal column frequently occur: but if luxation of the spine ever does happen, it is extremely rare; as in the numerous instances which I have seen of violence done to the spine, I have never witnessed a separation of one vertebra from another through the intervertebral substance, without fracture of the articular processes; or, if those processes remain unbroken, without a fracture through the bodies of the vertebræ. Still I would not be understood to deny the possibility of dislocation of the cervical vertebræ, as their articular processes are placed more obliquely than those of the other vertebræ. I must, however, observe that, from the vicinity of our hospitals to the river, sailors are often brought into them with injuries of the spine, by falls from the yard-arm to the deck; and as there is almost always an opportunity of inspection in these cases, a dislocation must be very unusual, since I have never met with a single instance of it, those injuries having all proved to be fractures with displacement.

Dislocations
very rare.

I am well aware that respectable surgeons have described dislocations as occurring in the cervical vertebræ; but I wish to state my own experience, with no further reference to that of others.

The following short account of the structure of the spine, is given merely to revive the ideas which may have faded from the memory.

The spinal column is composed of twenty-four vertebræ, which are divided into three classes; namely, the *cervical*, *dorsal*, and the *lumbar*: they are very strongly connected by four articular processes, and are firmly joined by an elastic substance, which proceeds from the broad surface of the body of one vertebra to that of the other. The spinous processes of many of the vertebræ, and particularly those nearest to the centre of the column, are locked together, one being admitted into a depression of the other.

Structure.

Bones.

Intervertebral
substance.

Anterior spinal
ligament.

Posterior spinal.

Intervertebral.

Capsular.

Ligamentum
subflavum.

Ligamentum
nuchæ.

Capsular.

Circular.

Perpendicular.

Lateral.

The bodies of the vertebræ are united by a ligamento-cartilaginous substance, extremely elastic, and composed of concentric lamellæ, connected by oblique fibres, which decussate each other, but in the centre become mucous, so as to form a pivot, which supports the central line of the vertebræ; whilst the elasticity and compressibility of the outer edge of this uniting medium, allow the vertebræ to move upon this centre in all directions. The column is also further connected by an *anterior spinal* ligament, which proceeds from the second vertebra of the neck to the sacrum, and is united to all the bodies of the vertebræ, excepting the first. There is also a *posterior spinal* ligament, situated within the canal of the spinal column, and proceeding from the second vertebra; but it is also intermixed with the perpendicular ligament; and descending to the sacrum, it sends out lateral processes to the superior and inferior edges of the bodies of the vertebræ. *Intervertebral* ligaments also pass in a crucial direction from vertebra to vertebra. The articular processes are united by *capsular* ligaments, and the transverse processes have ligaments passing from the one to the other. Between the arches of the roots of the spinous processes is placed an elastic ligament, called the *ligamentum subflavum*, which allows of considerable separation of the spinous processes; and, by its elasticity, approximates them, rendering muscular support for the erect position of the body less necessary. The vertebræ of the neck are united at their spinous processes by an elastic ligamentous substance, which is termed the *ligamentum nuchæ*.

The head is connected to the spinal column by *capsular ligaments*, enclosing the condyles of the os occipitis and the articular processes of the atlas, or the first vertebra.

A *circular ligament* proceeds from the foramen magnum to the edge of the aperture of the first vertebra.

A *perpendicular ligament* passes from the anterior part of the foramen magnum to the dentiform process of the second vertebra.

Lateral ligaments proceed from the edge of the foramen magnum and first vertebra on each side, and are united to the dentiform

process of the second vertebra: these ligaments limit the lateral motions of the head.

The first vertebra of the neck is united to the second by means of a *transverse ligament*, which is also fixed to the first vertebra on each side, and passes behind the dentiform process of the second vertebra. Transverse.

The spinal column, from the two important purposes which it serves, namely, that of supporting the head and all that part of the body situated above the pelvis, and also from its containing and protecting the spinal marrow, upon which the volition and sensation of the extremities depend, is, by the number of its bones, the strength of its joints, and its connection with the bones of the chest, most carefully protected from external injury.

The effects which are produced by violence done to the spinal cord are very similar to those which are produced by injuries to the brain;—for example:— Effects of injuries.

Concussion.

Extravasation.

Fracture.

Fracture with depression.

Suppuration and ulceration.

CONCUSSION OF THE SPINAL MARROW.

When a person receives a very severe blow upon the spine, or, from any great force, has it very suddenly bent, a paralysis of the parts beneath will frequently succeed, in a degree proportionable to the violence of the injury; but after such an effect, the person, in general, gradually recovers the motion and sensation of the parts. Concussion.

A man was admitted into Guy's Hospital under the care of Dr. Curry, who had received a severe blow from a piece of wood, which falling upon his loins, knocked him down; and as he came to the hospital on the regular day of admission, and not immediately after he had received the injury, he was placed amongst the physician's patients. His lower extremities were in a great Case.

degree deprived of motion, and their sensibility was much diminished. When resting upon his back in bed he could slightly draw up his legs, but he could not bend them to a right angle with the thigh; and a considerable time elapsed before he could make the muscles of the lower extremities obey the effort of his will. As there was still the appearance of severe contusion and much deep-seated tenderness in the situation of the blow upon the loins, Dr. Curry ordered blood to be repeatedly drawn away by cupping, and the bowels to be acted upon by calomel; and when the pain and tenderness, in consequence of the contusion, had been removed, a blister was applied to the loins, and a discharge supported for three weeks by the application of the unguentum *sabinæ*. The liniment *ammoniacæ* was ordered to be daily rubbed upon the lower extremities. In six weeks the motion and sensation of his legs had almost entirely returned, and he was then directed to be submitted to the influence of electricity. By this treatment, in ten weeks he completely recovered.

I lately attended a gentleman, who, by a fall from his gig, had received a severe blow upon his loins, and who had, at first, great difficulty in discharging both his urine and *fæces*; but he was relieved by fomentation and cupping.

EXTRAVASATION IN THE SPINAL CANAL.

Extravasation.

Spinal marrow
examined in
dissection.

A very severe blow upon the vertebræ will sometimes produce extravasation upon the spinal cord, but more frequently upon the sheath in which it is contained. Of late years it has been our custom, in examining dead bodies, to saw off the spinous processes of the vertebræ, the more accurately to examine the spinal marrow: and under such circumstances, in cases of severe injury, blood has been several times found on the outer side of the spinal sheath; and, in one instance, it occurred upon the spinal marrow, just above the *cauda equina*.

The case which best illustrates this subject, is one which I visited with Dr. Baillie, and Mr. Heaviside; and the particulars of which I have obtained from Mr. Heaviside, whom I have ever

found ready to make his beautiful anatomical collection useful to the profession.

Master ———, a fine youth, aged twelve years, in June 1814, Case. was swinging in a heavy wooden swing, and, in just commencing the motion forwards, was caught by a line which had got under his chin, by which accident his head and the whole of the cervical vertebræ were violently strained; as however, the line slipped immediately off, he thought no more of it. Subsequently to the accident, for some months, he was not aware of any pain or inconvenience, but his school-fellows observed that he was less active than usual: instead of filling up his time by play, he would be lying on the school forms, or leaning on a stile or gate when in the fields. They were always teasing him on this account; and at last he was persuaded that he was weaker than he used to be. From this time he continued to decline both in strength and power. About the middle of May following, he came to London. His complaints were occasional pains in the head, which were more severe and frequent about the back of his neck (where a blister had been applied without relief) and down his back. The muscles at the back of the head and neck were stiff, indurated, and very tender to external pressure. He felt pain in moving his head or neck in any direction: added to these symptoms, there was a great deficiency in the voluntary powers of motion, especially in the limbs.

May 18th. Two setons were made in the neck; and he was ordered various medicines, none of which proved useful.

May 29th. His complaints and the paralytic affection of his limbs were getting much worse; added to which he felt a most vehement hot burning pain in the small of his back. This, by the next day, was succeeded by a sense of extreme coldness in the same part. Some time after, the same pain occurred higher up in the back, and then disappeared. Pulse and heat natural.

June 3d. A consultation of Dr. Baillie, Dr. Pemberton, Mr. A. Cooper and Mr. Heaviside was held, and the application of mercury was determined on. The pil. hydr. was taken for a few

days; but as it ran off by the bowels, mercurial frictions were consequently preferred. He felt his limbs getting every day weaker, but his neck was less painful when moved, and he was more capable of moving it by his own natural efforts.

June 7th. His respiration became laborious; he passed a bad night. On the following day, all his symptoms increased; and at five in the afternoon he expired.

Dissection.

Dissection.

The whole contents of the head were carefully examined, and found perfectly healthy; but upon sawing out the posterior parts of the cervical vertebræ, the theca vertebralis was found overflowed with blood, which was effused between the theca and the enclosing canals of bone. The dissection being further prosecuted, this effusion extended from the first vertebra of the neck to the second vertebra of the back, both included.

The preparation only shews a small proportion of the ~~effused~~ blood which had become coagulated on the theca, because ~~and~~ of it, being fluid, escaped in the act of removal.

FRACTURE OF THE SPINE.

Produce symptoms of irritation on pressure.

These accidents, by admitting unnatural variations in the positions of the spinal column, produce very extraordinary symptoms, and sometimes sudden death, even when the bones retain their situation. Mr. Else, who preceded Mr. Cline as teacher of anatomy at St. Thomas's Hospital, used to mention the following case in his lectures.

Case.

A woman who was in the venereal ward at St. Thomas's Hospital, and who was then under a mercurial course, while sitting in bed, eating her dinner, was observed to fall suddenly forwards; and the patients hastening to her, found that she was dead. Upon examination of her body, the dentiform process of the second vertebra had been broken off; the head, in falling forwards, had forced the root of the process back upon the spinal marrow, which occasioned her instant dissolution.

At the time I lived with Mr. Cline as his apprentice, the following case occurred in his practice.

A boy, about three years of age, from a severe fall injured his neck; and the following symptoms succeeding the accident, Mr. Cline was consulted. Case.

He was obliged to walk carefully upright, as persons do when carrying a weight on the head: and when he wished to examine any object beneath him, he supported his chin upon his hands and gradually lowered his head, to enable him to direct his eyes downwards; but if the object was above him, he placed both his hands upon the back of his head, and very gradually raised it until his eyes caught the point which he wished to see.

If, in play with other children, they ran against him, it produced a shock which caused great pain; and he was obliged to support his chin with his hand, and to go immediately to a table, upon which he placed his elbows, and thus supporting his head he remained a considerable time, until the effects of concussion had ceased. He died about twelve months after the accident; and upon the inspection of his body, which was conducted by Mr. Cline, the first vertebra of the neck was found broken across, so that the dentiform process of the second vertebra had so far lost its support, that under different inclinations of the head, it required great care to prevent the spinal marrow from being compressed by it; and as the patient could not depend upon the action of the muscles of the neck, he therefore used his hands to support the head during different motions and positions.

Portions of the spinous processes are sometimes broken off, but these accidents do not usually affect the spinal marrow, unless when attended with considerable concussion. Mr. Aston Key, in dissecting a subject at St. Thomas's Hospital, found a spinous process loose, which he kindly brought to me, with the following account; "The fractured vertebra was the third dorsal; the cause of the accident I could not ascertain, as it occurred in a subject brought into the dissecting-room. There was a complete articulation formed between the broken surfaces, which had become Spinous process.

covered with a thin layer of cartilage. The synovial membrane and capsular ligaments resembled those of other joints, excepting that the former was more vascular. The fluid within the joint had the lubricating feel characterizing synovia."

Case.

A boy was admitted into Guy's Hospital, who had been endeavouring to support a heavy wheel by putting his head between the spokes, and receiving its weight upon his shoulders. The wheel overbalanced him, and he fell, bent double. When he was brought into the Hospital, although he had been perfectly straight before, he had the appearance of one who had long suffered from distorted spine; yet this injury had not produced paralysis of the lower extremities. Three or four spinous processes had been broken off, and the muscles torn on one side, so as to give an obliquity to the situations of the fractured portions. The boy quickly recovered without any particular attention, and was discharged with the free use of his body and limbs; but he still remained deformed.

FRACTURE OF THE BODIES OF THE VERTEBRÆ, WITH DISPLACEMENT.

Displacement of the vertebræ.

These fractures frequently come under our observation, producing displacement of the vertebræ. As the symptoms and result of the accident differ according to the situation of the fractured bones, these injuries may be divided into two classes; first, those which occur above the third cervical vertebra; and, secondly, those which occur below that bone.

These accidents fatal.

In the first class, the accident is almost always immediately fatal, if the displacement be to the usual extent. Death, in the second class, occurs at various periods after the injury. The origin of the phrenic nerve, from the third and fourth cervical pairs, is the reason of this difference; for as the parts below are paralyzed by the pressure upon the spinal cord, if the accident be below the fourth cervical vertebra, the phrenic nerve retains its functions, and the diaphragm supports respiration; but if, on the contrary, the fracture be situated above the origin of this nerve.

death immediately ensues. It is true, that a small filament of the second cervical nerve contributes to the formation of the phrenic, but is in itself insufficient to support respiration under fracture of the third vertebra.

The effects which arise from fracture and displacement of the spine, below the origin of the phrenic nerve, depend upon the proximity of the accident to the head. If the lumbar vertebræ be displaced, the lower extremities are rendered so completely insensible, that no injury inflicted upon them can be perceived by the patient. Pinching, burning with caustic, or the application of a blister, are alike unfelt. The power of volition is completely destroyed, not the smallest influence over the muscles remaining. The sphincter ani loses its power of resistance to the peristaltic motion of the intestines, and the fæces pass off involuntarily. The bladder is no longer able to contract, and the urine is retained until drawn off by a catheter; and yet the involuntary powers of the limbs remain nearly the same as before. The circulation proceeds, although perhaps somewhat more languidly, but sufficiently to preserve their heat; and local inflammation can be excited in them. A blister applied upon the inner part of the thigh or leg, of which the patient is wholly unconscious, will still inflame, vesicate, and heal; shewing that the involuntary functions may proceed in parts which are cut off from their connection with the brain and spinal marrow*. The penis, under these circumstances, is generally erect. Patients die from this injury at various periods, according to the degree of displacement of the vertebræ. In general, in fractures of the lumbar vertebræ, the patient dies within the space of a month or six weeks after the injury; and usually for some time before death, the urine passes off involuntarily, from extreme debility. I remember a patient of Mr. Birch, in St. Thomas's Hospital, who lived more than two years after this accident, and then died of gangrene of the nates.

Displacement
below the phre-
nic nerve.

Lumbar verte-
bræ.

* I have always thought, that although sensation and volition depend upon the brain, the spinal marrow, and the nerves, yet the involuntary functions depend principally upon the nerves.

Displacement of
the dorsal ver-
tebræ.

In fractures and displacement of the dorsal vertebræ, the symptoms are very similar to those described in fractures of the lumbar; but the paralysis extends higher, and the abdomen becomes excessively inflated. I remember one of our pupils saying, when a patient was brought into Guy's Hospital who had suffered from injury to the dorsal vertebræ, "Surely this man has ruptured his intestines, for observe how his abdomen is distended." But the first fæcal evacuation relieved this state, and proved that it had merely arisen from excessive flatulency. This symptom proceeds from diminished nervous influence in the intestines*; for although their peristaltic motion can proceed independently of the brain and spinal marrow, yet it is quite certain that the involuntary functions of the intestines, like those of the heart, can be influenced by the brain and spinal marrow; for we see even states of the mind producing affections of the intestines: one state rendering them torpid, and another irritable; as we see the heart leaping with joy, and depressed by disappointment. We also observe pressure on the brain rendering the intestines very difficult of excitement, even through the influence of the strongest aperients. From displacement of the dorsal vertebræ, death sooner succeeds than in similar injuries to the lumbar, the patient usually surviving the accident not more than a fortnight or three weeks; but still I knew a case of a gentleman in the city, who met with this accident, and who lived rather more than nine months. The period of existence is short or protracted, as the injury is near to or distant from the cervical vertebræ, and as the displacement is slight or considerable; it depends also upon the degree of injury which the spinal marrow has sustained.

Fractures of the
cervical ver-
tebræ.

Fractures of the cervical vertebræ, below the origin of the phrenic nerve, produce paralysis of the arms, as well as of the lower parts of the body; but this paralysis is seldom complete. If it occurs at the sixth or seventh vertebra, the patient has some feeling and powers of motion; but if at the fifth, little or none.

* Preceding dissolution, in almost all diseases, a great evolution of air into the intestines is observed, and from the same cause.

Sometimes one arm is much more affected than the other, when the fracture is oblique, and the axillary plexus of nerves is, in consequence, partially influenced. Respiration, in these cases, is difficult, and is performed wholly by the diaphragm, the power of the intercostal muscles being destroyed by the accident. The abdomen is also tumid from flatulency, as when the dorsal vertebræ have sustained injury. The other symptoms, in regard to the lower extremities, the bladder, and the sphincter ani, are the same as in fractures of the vertebræ below the cervical. Death ensues in these cases in from three to seven days, as the disease happens to be seated in the fifth, sixth, or seventh vertebra. I have scarcely known the subject of this injury to live beyond a week, and but rarely to die on the second day, although they sometimes die so early if the fifth cervical vertebra has sustained the injury. I have already stated, that in fractures and displacements above the fourth cervical vertebra, death almost instantaneously follows. The longest life I have known after such an accident has been ten months.

In the dissection of these cases, the following appearances are found :—The spinous process of the displaced vertebra is depressed ; the articular processes are fractured ; the body of the vertebra is broken through ; for it but rarely happens that the separation and displacement occur at the intervertebral substance. The body of the vertebra is usually advanced from half an inch to an inch. Between the vertebræ and the sheath of the spinal marrow blood is extravasated ; and frequently there is extravasation of blood on the spinal cord itself. The spinal marrow is compressed and bruised in slight displacements, and is torn through when the injury has been very extensive ; but the dura mater remains whole. A bulb is formed at each end of the lacerated spinal marrow, which laceration is usually produced by the bony arch of the spinous process. Dissection.

A most interesting case of this accident has been published by Mr. Harrold, an intelligent surgeon at Cheshunt ; and a prepara-

tion made from the case is preserved in the Museum at the Royal College of Surgeons.

The outline of the case is as follows—

Case.

A man, twenty-eight years of age, was knocked down by a quantity of chalk, which, falling upon him, broke his spine at the lower part of the dorsal, or the beginning of the lumbar vertebræ.

The principle upon which Mr. Harrold proceeded was, to produce union of the bones, by preserving the spine perfectly at rest; and to effect this object the patient was placed in a fracture-bed, which permitted him to evacuate his bowels without disturbance. The urine was drawn off daily by the catheter for several weeks; after which time he was able to retain from a pint to a pint and a half, and to discharge it when he pleased. A wound was produced upon the sacrum, from the constant pressure of his body upon the bed; and although he was insensible of it, the sore gradually healed.

Symptoms.

At the end of six months, his state was as follows:—His back was straight, flexible, and apparently as strong as ever. He retained and passed his urine, but probably he discharged it more by the action of the abdominal muscles than by any contraction of the bladder. He had a stool once in three or four days. His health and spirits were good, but he had neither sensation nor volition in the lower extremities. He dressed himself entirely; he let himself down stairs step by step. He died after the lapse of twelve months (wanting nine days) from the accident, owing to a sore on the tuberosity of the ischium, and to disease of the bone.

Examination.

I carefully examined the preparation, which is preserved in the Museum of the College, and found the following circumstances.

The bodies of the first and second lumbar vertebræ had been fractured; the first had advanced, and the second had been forced backwards.

The fracture had united by ossific matter, which had been spread over the fore part of both vertebræ to a considerable extent, and a little had been deposited upon the dorsal vertebræ.

The spinal canal had been much diminished by a portion of bone forced into it from the first vertebra of the loins; this portion of bone had split the theca vertebralis into two, and divided the spinal marrow almost entirely; a bulbous projection of the spinal marrow appeared above and below the bone, formed by its divided extremities, which were separated nearly an inch from each other.

Mr. Brookes also had a preparation in his late excellent anatomical collection, of fracture of the spine at the seventh and eighth dorsal vertebræ. The person had lived sufficiently long for a great deposit of ossific matter to have formed upon the anterior and lateral parts of the fractured vertebræ. The spinal marrow was almost entirely torn through, but the spinal sheath remained. Mr. Brookes could not learn how long the person had survived the accident.

As to the treatment of these cases, I fear that whatever may be done, the majority of them will prove fatal.

To bring the spine into its natural form by extension would be impossible, if it were attempted; and even if that object were attained, it would scarcely be practicable to preserve it in its situation, as the least motion would again displace it. Rest will be essential to ossific union; but ossific union will not save the patient if the pressure upon the spinal marrow be not removed.

Mr. Henry Cline was the only person who took a scientific view of this accident. He considered it to be similar to fracture with depression of the cranium, and to require that the pressure should be removed; and as the cases had proved so uniformly fatal, he thought himself justified in stepping out of the usual course, with the hope of preserving life. He made an incision upon the depressed bone, as the patient was lying upon his breast, raised the muscles covering the spinal arch, applied a small trephine to the arch, and cut it through on each side, so as to remove the spinous process and the arch of bone which pressed upon the spinal marrow. The only case in which he tried it, did not succeed; and unfortunately he did not live to bring his opinion sufficiently to

Ossific matter.

Operation by
Mr. H. Cline.

the test of experiment, to warrant a decided judgment. He was blamed for making this trial. I am not sure that he would have been ultimately successful; but in a case otherwise without hope, I am certain that such an attempt was laudable*.

In those cases in which the first and second cervical vertebrae have been broken and displaced, death, from obstructed respiration, is too sudden to allow time for any surgical relief.

INFLAMMATION AND ULCERATION OF THE SPINAL MARROW.

The only case which I could determine to be of this nature by dissection was the following:—

Case.

A gentleman who resided about eight miles from London, had, by a fall, received a severe blow upon the spine; but as it produced no immediate ill effect, he thought very lightly of it. In going down to his country house, he was exposed to the inclemencies of the weather; and he was on a sudden seized with a pain in his back, and paralysis of the lower extremities, retention of urine, and an involuntary discharge of fæces. I was requested to see him on account of the retention of urine, and went daily for a length of time to Wimbledon Common, where he resided, to make use of the catheter. For several weeks his symptoms remained unchanged, excepting that now and then the integuments of the sacrum gave way, and required great attention to prevent a dangerous sore. Towards the close of his existence he complained of a sense of uneasiness and distention at the upper part of the abdomen. His appetite failed him; he rejected his food and had a great deal of fever, with quick pulse and profuse perspiration. He sunk gradually, worn out by irritation.

I removed the spinal marrow, and have it preserved in the collection at St. Thomas's Hospital. Upon opening the spinal sheath, a milky fluid was found within it, just above the cauda equina;

* I beg the reader to observe that this operation is not mine; that I have expressed some doubts of its ultimate success: but I wish the trial to be made, as the only means of deciding positively on its utility; and if it saves only one life in a hundred, it is more than I have yet seen accomplished by surgery.

and higher than this, for the space of three inches, the spinal marrow was ulcerated to a considerable depth, and was in the softened state which the brain assumes when it is rendered semi-fluid by putrefaction. All the other parts of the body were healthy, excepting the bladder, which was considerably inflamed, and exceedingly extended by the long-continued retention of the urine.

In a case similar to this, it will be necessary to make use of precautions to prevent inflammation, by cupping or by leeches. Blisters should be applied; and if the fever still continues, a seton should be made, or issues be opened, to prevent the continuance of inflammation, by producing and supporting external irritation.

END OF VOL. II.



